SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LII.—No. 8. [NEW SERIES.] NEW YORK, FEBRUARY 21, 1885. [$3.20 per Annum. [POSTAGE PREPAID.]

THE MOTIVE POWER OF THE PHILADELPHIA CABLE RAILWAY.

The present plans of the Philadelphia Traction Company comprise a little over 20 miles of cable road, divided into three districts or routes. Each of the three stations is provided with two engines, which may be used singly or in combination, and six boilers arranged in pairs. The Market Street station, located at 19th Street, operates a line to Front Street and return, a distance of 19,000 feet, and also a line to 42d Street, a distance of 20,000 feet. The Sansom Street station, at 9th Street, works a line to 7th Street, to McKean, to 9th, to Sansom, and to the station, a distance of 19,000 feet; the second line from this station extends to 9th Street, to Spring Garden, to 7th, to Master, to Franklin, to 7th, to Sansom, to station—19,000 feet. From the Columbia Avenue station one line runs to 33d Street, where it connects with an auxiliary cable forming a loop, and designed to accommodate summer travel to the Park and return, a distance of 9,000 feet; the second line leads through Columbia Avenue to Franklin Street, to Master, to 7th, to Columbia Avenue, to station—19,000 feet. It is expected that the speed on all of these lines will be about 7 miles an hour, with the exception of that from the Market Street station to 42d Street, which will be 9 miles, and the loop in the Park, which will be 3½ miles.

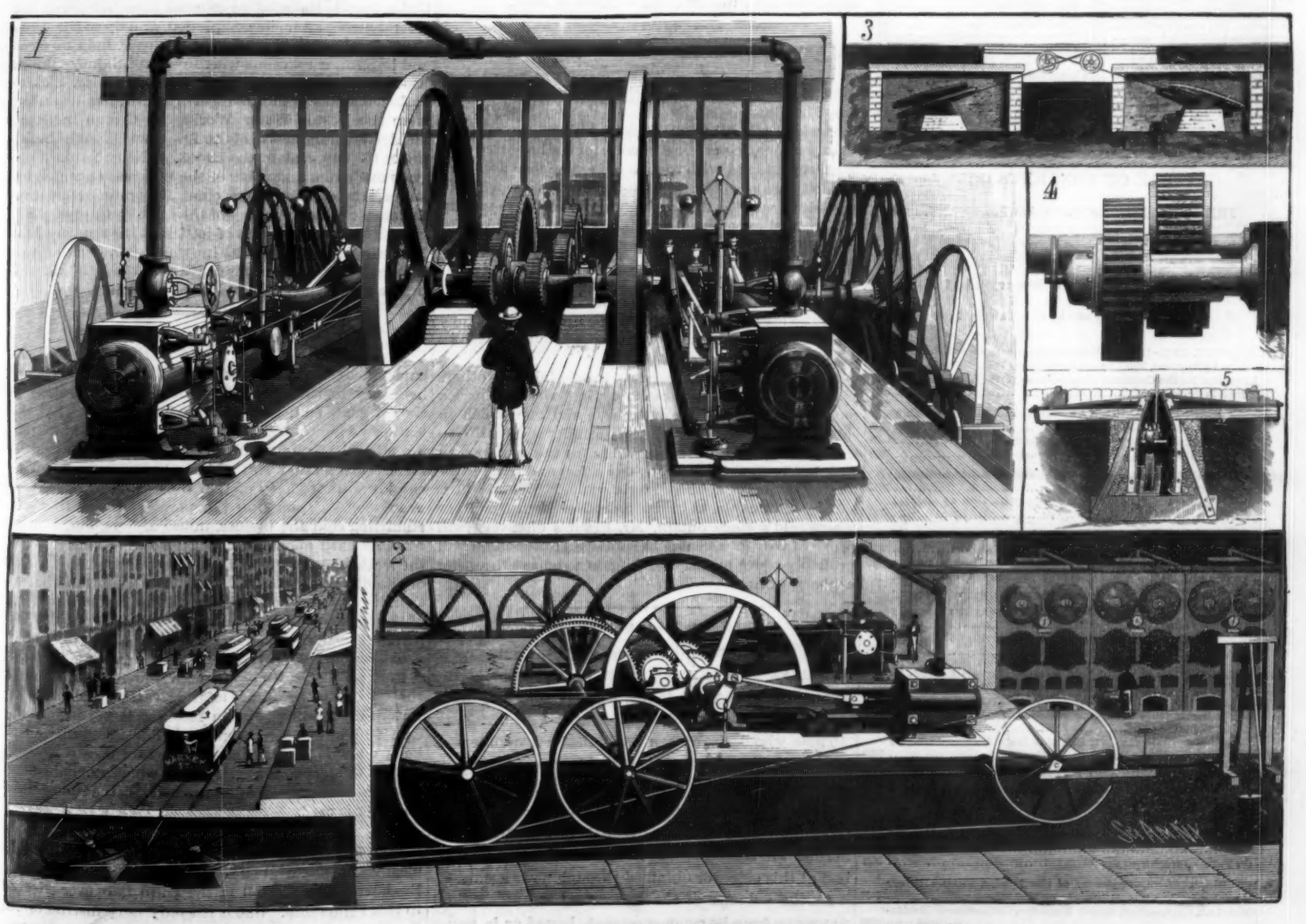
The engines, built by Messrs. Robert Wetherill & Co., of Chester, Pa., are of the Corliss type, and are conspicuous for their symmetry of design and the very apparent rigidity of construction. Many new features have been introduced by the makers, which render certain the action of the valve motion and governing mechanism, which increase the effectiveness and durability, and which combine all the essential elements conducive to the highest economy in the consumption of steam.

The cylinders are 24 by 48 inches; each engine is 260 horse power, making 520 horse power in each station. The valves are given a much larger bearing surface than is generally allowed, thereby allowing the engine to work under high pressure without cutting the valve seats, which are bored out perfectly true with tools specially constructed for this purpose. To insure a quick and quiet closing of the steam ports when the steam valves are liberated by the governor, a form of vacuum pot is used which avoids the inertia of the old style weight dash-pot. These are mounted on a piece projecting from the cylinder stand, and being in sight, above the floor, are in easy reach. In operation, a vacuum is formed in a small cylinder, when its plunger is raised by the opening of the valves; and the instant that detachment is made by the governor, this is exerted to force down the plunger, and reverse the direction of motion of the valves to close the ports. The requisite amount of cushion, obtained by a large chamber above the cylinder, is controlled by a screw covering a passage in communication with this chamber; all shock to the valve gear is thus prevented.

The cylinder heads are made with ground joints, thus doing away with all packing, and the back heads are entirely covered with a cap which presents a surface easily cleaned, and provides a chamber that may be filled with non-conducting material. The piston head is made in one piece, cast hollow and ribbed, giving the necessary strength with one-half the weight of the ordinary piston. The rings are of cast iron cut in segments, and lapping each other to break joints. Steam is not admitted under the rings to set the packing out, the joint against the surface of the cylinder being effected by German silver elliptic springs attached to each segment, and so adjusted that an equal pressure is exerted against the bore of the cylinder. The tightness of these pistons has been frequently tested by running the engine single acting, with back head off, when the packing showed no signs of leaking. The cross head pin is placed in the vertical center line of the shoes, which are adjusted by means of large screws held in position by jam nuts. The pin is lubricated through a curved branch, secured to the center, and provided with a sight feed cup, the oil being carried through the center of the pin and discharged on the top surface by suitable channels. This construction of cross head prevents the rocking of the center of the head up and down at every stroke, as is frequently the case when the pin is located forward of the center of the shoes. The connecting rods are of hammered iron, and in length are 5½ cranks; they are made with square end straps, which present a large bearing surface for brass, making it impossible for the box to get out of position, and heat. The boxes are of bronze metal, and have large wearing surfaces working on steel pins. The frame is heavy and rigid, with broad center support under the forward end of the guides. The castings of the pillow blocks are heavily proportioned, thoroughly ribbed, and provided with removable bearings.

The general arrangement of the gearing and winding drums, built by Messrs. Robt. Wetherill & Co., of Chester, Pa., by which power is transmitted from the engine to the cables will be understood from the engravings, Figs. 1 and 2, which show the engines at the Market Street station. The crank shaft is of hammered iron, is 12 inches in diameter, and mounted upon it, between the main and outboard pillow blocks, is a cast iron flywheel, 18 feet in diameter, and weighing 40,000 pounds. Upon the end of the shaft is a cast iron pinion, 40 inches in diameter, 14 inches face, and formed with thirty teeth. Each of these pinions is so mounted, with a feather, that it may be moved to the extreme outer end of the shaft, when it will be disengaged from

(*Continued on page* 117.)



THE MOTIVE POWER OF THE PHILADELPHIA CABLE RAILWAY.

Scientific American.

ESTABLISHED 1845.

MUNN & CC., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included..... $3 20
One copy, six months, postage included..... 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses as desired.

The safest way to remit is by draft, postal order, or registered letter. Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies, 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, FEBRUARY 21, 1885.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT,

No. 477,

For the Week Ending February 21, 1885.

Price 10 cents. For sale by all newsdealers.

CAST IRON MALLEABLE.

After all that has been written to define the difference between malleable iron and cast iron made malleable, there is a lack of information that requires further statements of facts. In the parlance of our English cousins, malleable iron is our "wrought iron." All wrought iron is considered malleable—capable of being spread under the hammer—but our malleable iron is brittle cast iron made capable of being bent cold, of being changed as to form by pressure or by percussion, and sometimes of being forged like real malleable, or "wrought," iron.

But cast iron can be softened without being made malleable; it is simply a process of annealing. Small articles of cast iron frequently become so chilled in the sand of the mould as to be impervious to the coaxing of the file or the persistence of the drill. In some establishments where minute iron castings are made, it is necessary to anneal them, even if they are not to be subjected to any tool processes; the attrition of the tumbling barrel would test their tenacity. As they come from the foundry, they are as brittle as unannealed glass. To anneal these brittle products, they are packed in cast iron boxes with sand—ordinary quartz sand—subjected to a red heat for about forty-eight hours, and allowed to cool gradually. There is no chemical virtue in the sand—it is merely a conservator of the heat, and the degree of heat is not sufficient to fuse the sand or to even round the corners of the sprews of the castings.

But to make cast iron malleable—to change its quality from the brittle, almost vitreous, condition of the casting to that of the almost plastic or malleable quality—requires a different treatment. The art is not modern, for as long ago as 1828 the Franklin Institute awarded a premium to Seth Boyden, of Newark, N. J., "for an assortment of buckles, bits, and other castings of annealed cast iron remarkable for smoothness and malleability." The uses of the process have been greatly extended since 1828, and its possibilities are better understood now than then. Kitchen spoons which are to be tinned are not made of wrought iron, but they are cast and made malleable. The blanks for the spoons are cast of iron, perfectly flat, giving only the outline of a spoon. These blanks are so brittle that they have to be handled like eggs in packing them for the softening process. When made malleable, and cooled, they are "struck up"—formed—in dies, and tinned or nickeled. Skate irons are produced in the same way. The irons are cast iron; then subjected to the malleable process, dressed, and finished, and case-hardened. It is claimed by some skaters that these skate irons are superior to those made of steel.

A NEW REMEDY FOR THE IMPORTED CABBAGE WORM.

Professor C. V. Riley says: "One of my correspondents, Mr. Charles H. Erwin, of Painted Post, N. Y., has accidentally hit upon so simple and yet, according to his experience, so perfect a remedy for the imported cabbage worm that I wish to give his experience as much publicity as possible, that it may be widely tested and, if possible, verified the coming season. It is, to sum up an extended experience which he narrates, simply ice cold water, or water but a few degrees warmer than ice water, sprinkled upon the worms during the heat or the day. Mr. Erwin found that such an application in the hot sun caused them to quickly let go their hold upon the leaves, curl up, roll to the ground, and die, while the cabbages suffered nothing, but looked all the fresher for the application.

Should this method prove as successful with others as it has with him, it is evident that we have here a remedy of very general application, and one which in cheapness and simplicity far transcends the Pyrethrum which, since I discovered its value for the purpose, in 1880, has been, on the whole, our safest and most satisfactory remedy against Pieris rapae. Where ice is readily obtainable, as in the more Northern States, or where cold springs obtain, Mr. Erwin's discovery will prove of very great value to cabbage growers, and will probably prove just as useful against some of the other cabbage worms."

Notice to New Subscribers.

Most subscribers to this paper and to the SCIENTIFIC AMERICAN SUPPLEMENT prefer to commence at the beginning of the year, Jan. 1, so that they may have complete volumes for binding.

Those who desire it can have the back numbers of either edition of the paper mailed to them, but unless specially ordered, new subscriptions will be entered hereafter from the time the order is received.

Bound volumes of the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT for 1884 may be had at this office, or obtained through news agents.

All the volumes of the SCIENTIFIC AMERICAN SUPPLEMENT from its commencement, bound or in paper covers, may be had as above.

The Worker in England and in America.

Mr. D. Pidgeon at the Society of Arts, London, lately read a paper on "Labor and Wages in America." Following in the early part of his paper somewhat closely on the lines of his recently published book, "Old World Questions and New World Answers," Mr. Pidgeon first drew attention to the radical differences which distinguish native American from alien labor, exemplifying the high condition of the former by the Lowell of forty years ago as described by Dickens, Miss Martineau, and others. He then sketched the social life of certain existing industrial towns, the "fastnesses" to which native American labor has, so to speak, been driven by immigrant operatives, who have imported into the States the lower life conditions exhibited by their class in Europe. After considering the efforts which are now being made in America by the state and by individuals to raise the status of alien labor to the levels of the past, he concluded that it was doubtful whether or not it is now rising or sinking in the social balance. Passing next to economic considerations, he stated what wages are now being paid to factory operatives in the States, their relation to the cost of subsistence, and to wages and the cost of subsistence in this country, concluding that while an English mechanic might vastly better his social condition by residence in the States, he would probably find himself little richer, in money, after paying the enhanced prices for subsistence and conforming to the higher standard of life prevalent in America. Finally, he attacked the doctrine that import duties influence wages, and showed that the movements of American and English wages during the last twenty-three years have been determined by some common cause which cannot possibly be due to the tariff, since this is operative in one of the two countries only.

Theophilus E. Sickles.

Theophilus E. Sickles died on the 2d of February, 1885, aged 62 years, after an illness resulting from inhaling the fumes produced by an explosion in one of the railroad tunnels whose construction he was superintending. In his death the railroad world loses one of its most prominent civil engineers. He was a native of Pennsylvania, and for many years had spent his summers in this State. The first railroad service which brought him into prominence was his building of the Hannibal and St. Joseph Railroad more than thirty years ago. He constructed the bridge of the Union Pacific Railroad from Omaha to Council Bluffs, the second tubular iron column structure of its kind completed in this country. He was connected with the Union Pacific Railroad as general superintendent for several years after its completion, and up to the time of his death was its consulting engineer, holding close and important relations with President Sidney Dillon. Among other notable works with which Mr. Sickles had connection either as chief or consulting engineer, were the Boston Water Works, the Croton improvement, the enlargement, the Erie Canal, and the building of the dry dock of the Brooklyn Navy Yard. Congress made him a member of the commission which examined the mouths of the chief European rivers preliminary to the beginning of the work by Captain Eads upon the latter's system of jetties at the mouth of the Mississippi River. Work in which Mr. Sickles was engaged at the time of his death was the building of a bridge across the Arkansas River at Little Rock.

Softening Leather.

Neatsfoot oil will not soften leather under all circumstances, neither is castor oil any better. Oil is not necessary to the pliability of leather—the leather of the ox, goat, calf, and kid. It is necessary that the leather be kept moist; but oil need not be the moistening means. Yet in use oil is the most convenient means for keeping leather soft. It would be inconvenient to employ water to keep pliable the leather of our boots, because of its spreading the pores of the leather and admitting cold air; besides, unless always wet, leather becomes hard and rigid. Oil, on the contrary, keeps the leather in a proper state for its best usefulness, that of pliability. But in order that oil may soften the leather, its way should be prepared by a thorough wetting of the leather by water. Much less oil is required if the leather is well saturated with water. The philosophy is obvious; water is repellent to the oil, and prevents it from passing entirely through the leather, holding the oil in the substance of the leather. The use of water for softening belts in factories is not inconvenient, if advantage is taken of a holiday. At night the belts may be brushed clean and thoroughly wetted, then in the morning use the oil; a much smaller quantity is necessary to render the belt pliable than when no water is used.

MRS. LOUISA REED STOWELL has just been elected a member of the Royal Microscopical Society, of London, England. Mrs. Stowell is the third lady ever elected to this Fellowship. She is the only lady instructor in the University of Michigan, and is the author of several treatises on microscopical subjects.

THE CHEMICAL NATURE OF COTTON.

BY E. DWIGHT KENDALL.

Cellular filaments, turgid with nutrient and astringent juices, springing from the nearly ripened seed and intertwining in a seeming tangled mass; soon lengthing and becoming hard and ligneous; then the remnant of the sap dries up within them, and they shrivel to flattened, twisted, sear (and sometimes yellow), lifeless—*cotton fibres.*

The chemistry of cotton began with the art of dyeing, in India; the ancient Egyptians were skilled in dyeing *al-quton:* they were not required to reconcile the cotton with coal-tar colors. A knowledge of the physical structure and chemical constitution of the cotton fibre does not explain its indifference to most dyes, nor can its affinity for a certain few coloring matters be understood, because it does not appear to form chemical combinations with these: they can be readily removed, leaving the fibre unchanged.

The ripe fruit of the cotton-plant (Gossypium, from the Arabic *goz*, a soft substance) is a large capsule containing a mass of the filaments, which envelop and adhere to the seeds. The fibres from different species of the plant vary in length, thickness, flexibility, tensile strength, and color; the diameters are from $\frac{1}{800}$ to $\frac{1}{2500}$ of an inch, and the lengths from 0·77 to 1·80 inches; the mean diameter of Sea Island cotton fibres is $\frac{1}{1287}$ of an inch and the average length 1·60 inches; some cottons are highly colored, like the so-called *Nankin*, and the whitest contains some natural coloring matter, which is of the same character in all cottons, and consists of two bodies, one freely soluble in alcohol, the other not.

Clean cotton is nearly pure *cellulose;* the associated substances are in varying and exceedingly small proportion, and may be removed by means of hot alkalies, dilute acids, and ether; the bodies obtained by this treatment are found to consist of waxy, albuminoid, and coloring matters; ulmic, pectic, and fatty acids; calcium and sodium sulphates; and ferric, silicic, and aluminium oxides, with traces of potash and magnesium phosphate. The ulmic acid perhaps results from the action of the chemical agents on woody tissue (not cellulose), and in like manner the pectic acid may be formed from insoluble pectose.

Cellulose is the principal material in the structure of plants; the natural process of its formation and its relations to allied bodies constitute one of the most interesting studies in science. The formula of pure cellulose is $C_6H_{10}O_5$, or $C_{12}H_{20}O_{10}$; therefore it is composed of carbon and the elements of water, or, empirically, it may be said to consist of carbon and water. It is isomeric with dextrine and starch, and differs from natural gum and the sugars (glucoses and saccharoses) only in the relative quantities of water elements. By simple chemical means cellulose may be changed to gum, to starch, and to sugar; by natural process the plant converts starch, gum, and sugar one into the other or into cellulose, according to the requirements of its different parts.

Are these changes, produced simply by alteration of molecular structure? "The theory of atomicity . . . interprets the most complicated cases of isomerism"—with exceptions. We know that the vital principle of the plant directs the formation of tubes of cellulose, as conduits of the sweet sap from which they are produced; that the same saccharine juice deposits gum and, in the seed, starch, and that this starch, in the new growth, by the stimulation of diastase, changes itself to the forms of gum, and sugar, and cellulose, exhibiting in matter phenomena that suggest the convertibility of the different forms of energy; but we cannot explain these transmutations, nor do we understand why the presence of a small quantity of acid should convert a handful of old rags into an equal weight of sugar.

How do plants produce these bodies, composed of carbon with hydrogen and oxygen in the same relative proportions as in water? The hydrogen can only come from water; the plant obtains that through its roots, and as it does not receive oxygen from the air, water may also furnish that element, while, under the influence of light, the leaves absorb carbon dioxide, the source of the carbon.

The plant now has water and carbon from which to form its starch, gum, sugar, and cellulose. By resolution of the carbon dioxide and directly combining carbon and water? The process of eremacausis, or natural decay of woody fibre, would indicate this. It consists essentially in evolution of water and oxidation of carbon, with reproduction of carbon dioxide. But another consideration forbids this view. Not only do plants form bodies composed of carbon, hydrogen, and oxygen, but they also produce waxes, caoutchouc, essential oils, and resins, consisting of carbon and hydrogen, and containing little or no oxygen; therefore the plant must have the power to decompose water, and appropriate only the hydrogen. Hence it seems possible that the cellulose and allied bodies are produced by the combination of hydrogen from water with carbon dioxide, the oxygen of the water being emitted.

Although cellulose is so readily convertible to gum, starch, and sugar, it resists chemical action in the stomach, and is as innutritious as clay. It is scarcely attacked by dilute acids and alkalies, but strong sulphuric acid and zinc chloride change its physical character; "parchment paper" and "vulcanized fibre" are respectively produced by these agents. A solvent of cellulose is obtainable by dissolving cupric carbonate (formed by precipitation from the sulphate) in ammonia; it easily dissolves cotton, particularly so-called "absorbent cotton," and acids precipitate the cellulose in flocculent form.

Remarkable changes are effected in the nature of cellulose or cotton by the action of concentrated nitric or mixed nitric and sulphuric acids; hydrogen is removed, and the radical nitryl (NO_2) substituted, with formation of pyroxylins or varieties of nitro-cellulose. True "gun-cotton," or trinitrocellulose, $C_6H_7(NO_2)_3O_5$, is made with the more concentrated acids, while acids containing more water yield less highly nitrated or "soluble" proxylins, which are used in the manufacture of collodion, celluloid, zylonite, etc. To determine whether the alteration of structure and chemical nature of the cotton fibre had developed affinity for aniline colors, a few tests were made with pyroxylins; ordinary rosaniline dyes were used, and the trisulphoacid of rosaniline (Holliday's acid magenta); the trinitrocellulose rejected the dyes, while the partially nitrated cotton retained the colors after washing with soap and water.

A way to make cotton receptive of colors, without the use of mordants, and means of rendering it less combustible, of removing the harshness of inferior grades, and of bleaching it cheaply without injury to the fibre are desiderata that have engaged the attention of many chemists. An increased affinity for dyes may be imparted by preparatory treatment with hot dilute alkali, which removes most of the waxy and fatty matters, and notably alters the shape and dimensions of the fibre; it contracts in length, and approximates to the form of a simple round tube, with a clear hollow from end to end.

Cotton may be distinguished from other vegetable fibres, such as flax and hemp, with the microscope, and from wool and silk by simple chemical tests; for example: hot dilute alkaline solution does not affect cotton, but quickly dissolves the animal products; a solution of the trinitrophenol picric acid dyes wool and silk a permanent yellow, but washes away from cotton, leaving it white; or instead of the dye, dilute nitric acid may be used, which produces picric acid from the animal substance; a hot solution of mercuric nitrate imparts a red color to wool and silk, but leaves the cotton unchanged; by boiling cotton with dilute hydrochloric acid it becomes rotten, while wool and silk are not thereby changed; a solution of lead monoxide in dilute alkali blackens wool, but not cotton; a solution of zinc chloride dissolves away silk from cellulose, etc.

A remarkable fact respecting cellulose is its production in the animal economy: it has been found in skins of the silk worm and serpents.

Magnitude of the New Orleans Exposition.

Director-General Bourke, with the view principally of obtaining a further government appropriation for carrying on the great Exposition at New Orleans, has recently made a report of the receipts and expenses, and showing the magnitude of the enterprise. It appears that up to January 27, owing to bad weather and the incomplete condition of the Exposition, the receipts were smaller by five to ten thousand dollars a day than had been expected, and thus the management became burdened with a deficit which reached more than $300,000. Since that date it is reported that the receipts have been equal to the disbursements.

There are on the grounds fifteen buildings erected by the management, covering an area, in square feet, as follows:

Main building	1,656,000
Government and State Exhibit building	648,825
Six live stock barns	136,080
Horticultural Hall	116,400
Iron machinery extension	49,000
Iron sawmill building	36,000
Iron boiler house	28,000
Iron art gallery	25,000
Iron wagon building	24,000
Iron, brick, and tile building	12,000
Eight ornamental entrances, Three police buildings, One drainage station, One waterwork station, One electric light building	12,000
Total area covered	2,726,305

In addition to the buildings constructed by the management, there have been erected upon the grounds: Mexican Commission and Headquarters building; Mexican building for mineral exhibit; two Public Comfort buildings; one Bankers' building; one Furniture Pavilion; one Terra Cotta Exhibit building; and ten structures of various sizes by individuals, aggregating 120,000 square feet, and making a total area of space covered by roof of 2,820,000 square feet. Six of the buildings constructed by the management are covered with iron, one principally with glass, and the remainder, embracing the principal buildings, are of Southern pine.

It thus appears, according to the official report, that the two main buildings of the Exposition cover a combined area of 2,304,825 square feet, or a greater area than was covered by the main buildings of the London Exhibition of 1862, Paris of 1878, Vienna of 1873 combined, or a larger area than the main buildings of the London Exhibition of 1862, say 1,400,000 square feet, and the Centennial of 1876, 876,206 square feet, combined. The area covered by the buildings erected by the management equals, it is said, the entire exhibiting area covered by all the buildings erected at the Centennial by the Centennial Commission, U. S. Government, foreign Governments, States, and Territories, and at less than one-fifth the cost.

The machinery plant or motive power of the exhibition is believed the largest ever collected, footing up 5,937 horse power, of which 1,900 horse power is required for the electric light part of the display. The engines furnishing this power are as follows:

	Horse Power.
Harris-Corliss engine, 30 x 72	650
Reynolds-Corliss, 32 x 60	600
Brown, 28 x 60	400
Wetherell-Corliss, 24 x 48	350
Wheelock, 24 x 48	300
Estes, 20 x 36	300
Taylor, 18 x 24	125
Buckeye, 15 x 27	150
Payne, 16 x 28	150
Lane & Bodley Corliss, 16 x 42	125
Reading Iron Works	150
Atlas	65
Six Westinghouse	145
Seven Armington & Sims	635
Armington & Sims	40
Four New York Safety	200
Russell	50
Ball	60
Westinghouse	150
Smith, Meyers & Snier	200
Fulton Iron Works	125
Allis	200
Stearns	200
Taylor	75
Bocage—Pine Bluff	50
Lane & Bodley	50
Russell	30
Salem	30
Erie	20
Harris-Corliss, Government building	150
Russell Planing Mill	25
Hewes & Phillips	100
Total	5,937

The electric light plant consists of: Seventy-three dynamos; four thousand Edison incandescent lamps; eight hundred Louisiana Electric Light Company's arc lamps; and five 36,000 candle power lights; three hundred Brush arc lamps; one hundred and forty Thompson & Houston arc lamps; and one hundred and forty Jenny arc lamps with five towers.

Foreign countries occupy the following amount of space allotted in the center of the Main building, viz.:

	Square Feet.
Austria-Hungary	16,008
Brazil	612
China	3,072
France	28,848
Great Britain	16,008
Honduras	2,184
Jamaica	1,632
Mexico	36,852
Sandwich Islands	576
Siam	576
Venezuela	576
Belgium	28,508
British Honduras	2,304
Costa Rica	672
Germany	5,412
Guatemala	1,440
Italy	8,671
Japan	6,720
Russia	16,508
San Salvador	288
Spain	1,440

Other exhibits are grouped as follows, viz:

	Square Feet.
Machinery exhibits	455,400
General exhibits	413,400
Furniture exhibits	34,200
Carriage exhibits	52,364
Art furniture and decoration	86,300
Mills	36,000
Machine tools	42,000
Textile exhibits	61,344
Food products exhibits—manufactured	68,600
Educational exhibits—commercial	31,672
Manufactures of metals	43,672

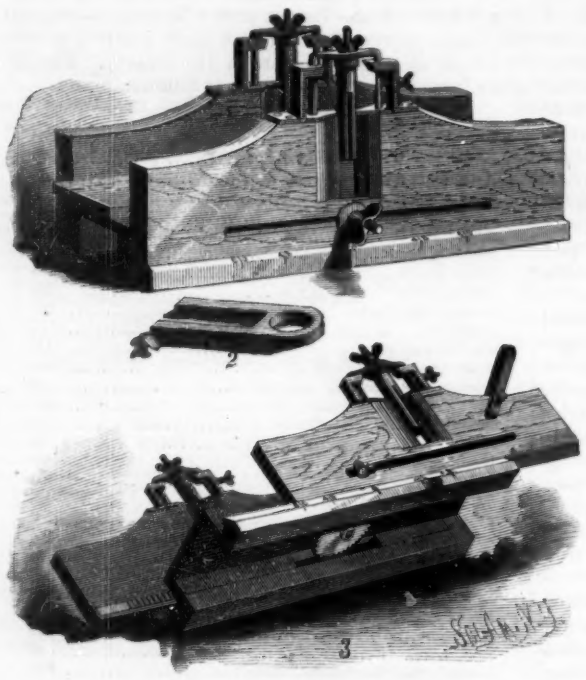
The main building and extensions are filled with exhibits, and twelve hundred applicants were refused because of a want of space, notwithstanding the fact that several additional buildings were erected or put under construction after it was discovered in November that the extensive buildings previously constructed were utterly inadequate. Large quantities of machinery and other exhibits, for which no space can be found, remain at New Orleans, awaiting the possibility of additional buildings or the completion of those begun. Work has been discontinued on newly designed buildings not completed, owing to lack of funds.

Cancer in Horses.

The *Indian Medical Gazette* says: *Melanotic cancer* is an ordinary cause of death in Bengal among gray and white horses. We can scarcely drive through Calcutta without seeing animals having the characteristic globular tumors beneath the skin.

IMPROVED MITER BOX.

The miter box herewith illustrated can be instantly adjusted for a cut at any angle from one to sixty degrees, or even eighty degrees. The side pieces can be moved longitudinally on the bed plate in opposite directions, the movement being so controlled by racks on the lower inside of both of them, working with a pinion between them, that when one side is moved longitudinally on the bed plate the other moves in the opposite direction over an equal distance. The side pieces are beveled at the bottom to fit into grooves in the base of the bed plate, in which they slide to and fro. Both



POWELL'S IMPROVED MITER BOX.

pieces have a slot cut through them near the bottom, extending about two-thirds the length, which allows them to move over the screw bolt that holds them to the bed plate. A screw bolt having a thumb nut and washer at one end and a broad head at the other extends across the box and its sides below the bed; this bolt holds the sides to the bed. (By removing this bolt, the box can be taken to pieces and packed in the carpenter's chest with the rest of the tools.) By loosening the nut, the side pieces may be moved along the grooves, and held firmly in any position by tightening the nut. The saw teeth are prevented from coming in contact with the bed plate by a loose bottom. In the sides are vertical openings, in which the saw guides hang suspended from above. These openings are beveled on both sides to permit the saw to swing at any angle across the bed, and their vertical edges are fitted with a metal shield which will cut on a circle to correspond to the circle of the surface on the saw guides and embrace them loosely, so that they cannot get out of place. The saw guide cylinders, of hard wood, are a little longer than the side openings, in which they fit loosely, and are formed with a central slot wide enough to take in the saw used. The upper ends of these guides are secured by bolts and thumb nuts to yokes supported by brackets fixed to the top edges of the side pieces. The yokes are formed with guide rods extending downward through openings made in the brackets and sides. The saw guides may be partially revolved by loosening their nuts, and they may be raised or lowered, together with the yokes and guide rods, and may be secured at any elevation by means of the set screws shown at the sides of the guide rods. On the base of one of the sides are marked figures to indicate the different degrees at which the saw may be set to cut. The pinion on the bottom, shown in Fig. 3, is attached by a bolt and nut to a bracket extending across the bed plate; this pinion engages with racks to move the sides to and fro, as mentioned above. Fig. 2 shows a spring clamp which can be affixed to either side of the miter box to keep the piece of lumber in the box in place.

This invention has been patented by Mr. W. J. Powell, of East Marshfield, Mass., from whom particulars regarding the United States and Canadian patents may be obtained.

An Invention Needed.

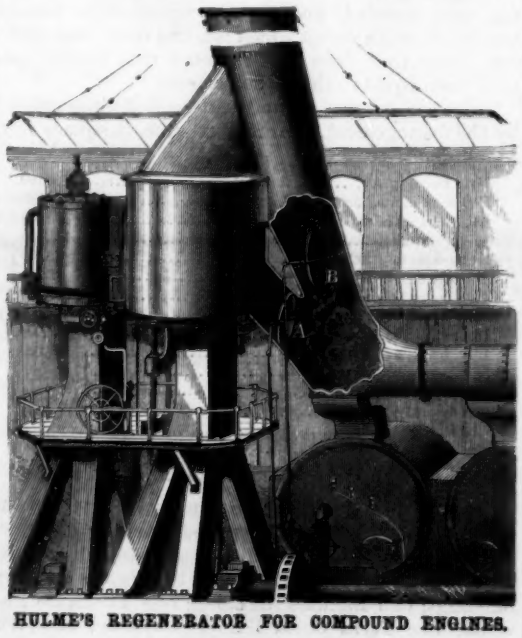
The inventor who will devise a cheap, speedy-working power press, which will press straw or hay into small solid blocks to furnish fuel for our vast woodless tracts of wheat country, would surely enrich himself. Such a press, if practical, cheap, and durable, would confer a great blessing upon the country. Millions of tons of straw and hay are now burned to waste which by such a device might be converted into valuable fuel. Our present straw-burning engines, although valuable, do not fully fill the bill.—*United States Miller.*

The Car Coupler Question.

Referring again to the inevitable car coupler question, candor compels the admission that the prospects for the adoption of any particular style or patent for general use throughout the country are not at all encouraging. The master car builders have wrestled with the question at every annual convention of their association for several years past, and at their last meeting proposed a plan, referred to in these columns recently, involving the collecting of a fund from the railways with which to thoroughly test the various couplers which are before the public, under the direction of Mr. M. N. Forney as the representative of the association. We learn that no action has yet been taken, however, looking to the carrying out of this plan, and that there is little prospect that it can be made successful. There are so many conflicting interests to be considered, and to be appeased or antagonized; so many patents, each of which, in the opinion of the inventor, is worth more than all the rest; so much money has been spent, so much stock has been disposed of, and there are so many ideas in direct opposition to each other, that in the nature of things the adoption of a universal coupler for freight cars is simply an impossibility. Even if the railway commissions of half the States in the Union were to recommend a particular coupler, such action would not result in a suspension of efforts to introduce scores of others. Men who have invested their capital in the manufacture of an article in the value of which they have perfect faith, will not close their doors, discharge their employes, and permit their plants to fall into decay because a number of railways or a number of railway commissions may have declared in favor of a competitor. While it may be that there has not yet been discovered a perfect coupler, there are, nevertheless, a number which possess sufficient merit to render a choice from among them a most difficult task. There seems to be no other way but to allow inventive genius and capital the same freedom to invent and manufacture and sell that is allowed the universal American citizen. It may be questioned, however, whether it is politic or just, either to the railways or inventors and manufacturers of couplers, to encourage the annual contest before the Master Car Builders' Association, which has involved outlay by these people, many of whom are not able to incur unnecessary expense.—*Railway Age.*

REGENERATOR FOR COMPOUND ENGINES.

The invention shown in the engraving, lately patented by Mr. Thomas Hulme, of Galveston, Texas, relates to that class of engines in which the products of combustion pass from the furnace around one or more of the steam cylinders. The furnace connects with the smokestack directly, and also by a divergent trunk, which is enlarged to form a chamber, so that all the products of combustion shall pass through the chamber when the damper, B, in the direct flue is closed. The low pressure cylinder is within the chamber, which is large enough to leave space around the cylinder sufficient for draught. The packing glands of the piston



HULME'S REGENERATOR FOR COMPOUND ENGINES.

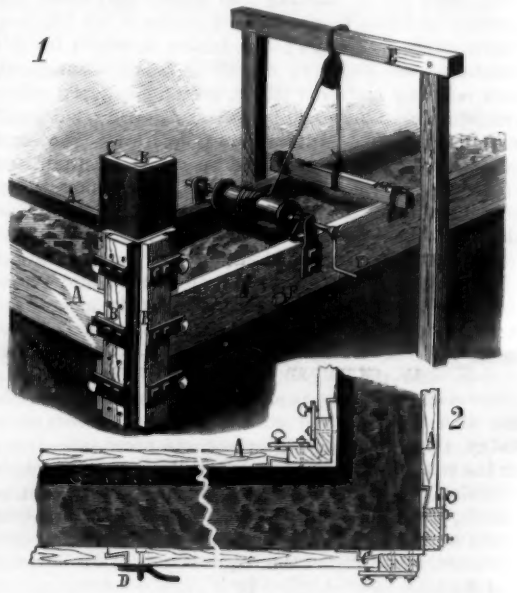
and valve rods project below the bottom of the chamber, so as to be accessible, and removable plates permit access to the cylinder head and steam chest cover. The damper, B, is to be opened when the fire is just starting up and when the engine is at rest. By this arrangement condensation in the cylinder is greatly prevented, the result being increased steam pressure. The chamber may be covered to prevent radiation of heat.

Shetland Pony and Percheron.

It is a difficult matter to believe that those magnificent specimens of equine power, the Percheron and Clydesdale draught horses, should be derived from the same original stock as the Shetland pony. These little, hardy, obstinate, good natured pets have been undergoing during a number of years a process of physical degeneration, which has reduced them to an average stature of forty to forty-eight inches, and often much less. They, like the oaks and firs of the island upon which they have been reared and bred, have become stunted in their growth by the peculiar conditions of their environment; while the other branch of the family has been interbred and selected and improved, with a view of producing the magnificent thoroughbreds which we now so often see in the business parts of our cities, and which are so often the pride of our State and county fairs and horse shows. In point of strength the pony probably stands ahead of the Percheron in proportion to its size, and wonderful stories are told in their native isle of their wonderful endurance and power.

APPARATUS FOR BUILDING CONCRETE WALLS.

The planks, A, forming the mould are tied together by cross bolts, and connected at the corners by angle pieces. At suitable points in the length of the wall, frames, E, are erected. A shaft carrying a drum is supported by brackets attached to the planks. A rope from the drum passes through a block suspended from the frame, and connects to a bar secured to the planks. The shaft is provided with a crank handle and adjustable collars, which prevent endwise move-



CARRICO'S APPARATUS FOR BUILDING CONCRETE WALLS.

ment and allow adjustment to any width of mould. A pawl on the mould engages a ratchet wheel on the shaft. The windlass is used to hoist the mould from a finished course into position for a new course. The method of splicing plank to form a mould of the desired length is shown at D, Fig. 2, the ends of the plank being held together by latches hung on screw pivots. At the corners the plank ends are fitted at the inside with strips, C, bent at the required angle; bars, B, are bolted to the strips so as to form shoulders for the ends of the plank to abut against. The same bolts hold plates that have clamping screws in the ends projecting over the planks, so as to hold the latter to the angle pieces. The angle pieces and bars are in length about three times the width of the plank, so that they will remain in place until three courses have been completed. The mould so constructed is firm, substantial, and easily handled, and its use insures a proper formation of the walls.

This invention has been patented by Mr. Thomas W. Carrico, of 912 Avenue C, San Antonio, Texas.

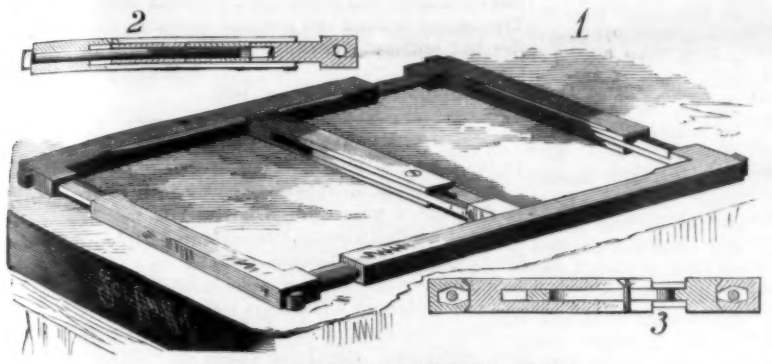
At the Top of Mount Washington.

A visitor to the top of Mount Washington concludes that the weather is really cold up there. He was convinced by a walk along the railroad, with the wind blowing seventy miles an hour and the thermometer twenty degrees below zero. The temperature does not get lower there than in many other places, but the wind blows with greater velocity, it is said, than at any known spot in the world, and this makes the cold unbearable. A velocity of 180 miles an hour has been attained, while at Pike's Peak, 8,000 feet higher, the greatest is 100 miles, and in New York 45 miles is a heavy gale.

The cold is so intense that if one covers every part of the body, leaving only the eyes exposed, these are soon coated with frost, which closes the lids and often makes it almost impossible to see. The moisture of the breath freezes under the coverings of the face, and a frost bite is the consequence.

IMPROVED PRINTER'S CHASE.

The chase shown in the cut can readily be adjusted to fit type forms of various sizes, thus permitting its use in place of the assorted chases now necessary in printing establishments where a variety of job work is done. The chase being, practically, self-locking saves all time usually spent in filling out with furniture, quoins, etc. Fig. 1 is a perspective view, Fig. 2 is a longitudinal section through one of the sides, and Fig. 3 is a section through the central brace. The chase consists of four similar L-shaped pieces; one arm of each piece being made so as to slide over and inside the part of the adjoining piece. The inner arm is made in the shape of a double-dovetail tenon, and in the arm it slides in is a double-dovetail groove, which extends nearly to the angle and joins a horizontal hole in which works the adjusting bolt. A threaded nut, embedded at a suitable point in the tenon, receives the end of the



BRILL'S IMPROVED PRINTER'S CHASE.

bolt. The inner, upper and lower edges of the grooved arms are beveled, and against these edges rest the ends of the central crossbar, which consists of two pieces, the form of which is clearly shown in the engraving. The central part of the tenon piece is slotted to receive the body of the fastening screw, which passes through a hole in the other part. The adjustment of the various parts of the chase may be easily and rapidly made; the manner of changing the size will be understood from the foregoing and from the engraving.

This invention has been patented by Mr. Peter Brill, Jr., whose address is care of Mr. A. C. Pleyte, 1719 Walnut Street, Milwaukee, Wis.

AN IMPROVED SAFETY ENGINE.

The accompanying engraving represents a safety engine of novel construction, invented by Mr. Henry Davey, a mechanical engineer of prominence in England, and now being manufactured by Messrs. Charles P. Willard & Co., of 284 Michigan Street, Chicago, Ill. Although the principle involved in its construction is not new, the application and combination have not before been used in small motors. It differs from a steam engine in the fact that while a small quantity of steam is used, it is not the motive power employed to do the work, the only function of the steam being to create, by condensation, a vacuum, which constitutes the motive power. There is absolutely no pressure in the generator, and consequently there can be no danger of explosion under any circumstances. The cylinder is provided with an internal cylinder, made of bronze, which is entirely surrounded by steam. The admission and cut-off are regulated by suitable mechanism operated by the engine itself. Condensation is effected by means of a surface condenser, which is contained in a pocket shown at the rear of the engine. The air pump, which connects with the condenser, and the hot well are of special construction, and are shown attached to the side of the main frame. The water supply is regulated by a valve contained in the float box shown at the side of the generator. The entire amount of steam generated is condensed, and is discharged through a small opening at the side of the hot well in the form of hot water. The engine is double acting, steam being condensed at both ends of the stroke, so that a vacuum is produced alternately at each side of the piston head. The water level of the engine is constant and unvarying, and the quantity of water actually consumed is so small as to remove all difficulty of keeping up a supply. There is no safety valve, no exhaust, no steam gauge, no boiler feed pump, no injector, nor any similar adjuncts of an ordinary steam engine. It is arranged to burn either hard or soft coal, wood, or coke, and petroleum or common gas may be used by conducting pipes into the fire box. The manufacturers claim that when hard or soft coal or coke is used, the cost will not exceed one cent per horse power per hour.

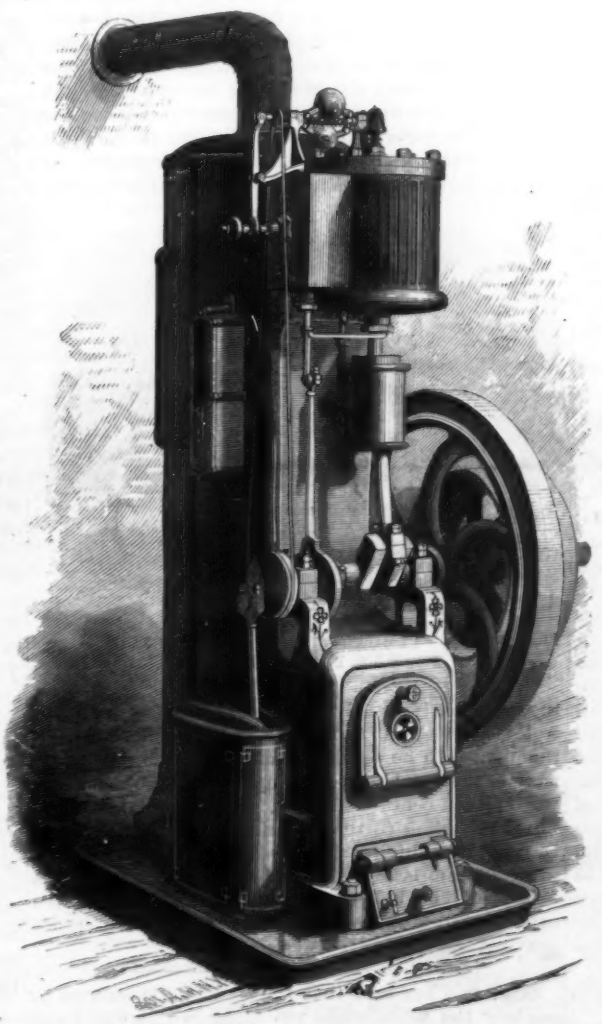
BARON VON SCHOELER, of Corpus Christi, has for a pet an immense snake of the anaconda species. It is perfectly docile, so far as the Baron has yet learned.

Natural Gas in Pittsburg.

On January 31, a disastrous explosion of natural gas occurred at Pittsburg, Pa., by which four houses were badly damaged and twenty-two persons were more or less injured. The large main of the Fuel Gas Co., conducting the natural gas from the wells at Murrysville to the consumers in Pittsburg, passes close along the curb on Butler Street at Thirty-fourth. The pipe is wrought iron with screw joints. The high pressure of the gas and its great penetrative quality make it, seemingly, impossible to prevent leakage. The gas accumulating in cellars near the corner of Thirty-fourth and Butler Streets in large quantities was ignited and exploded. These explosions are of alarming frequency. The gas companies, with all known appliances for controlling the gas, cannot master it. The Fuel Gas Co. is trying a new plan. Their pipes will be surrounded with charcoal. In close proximity to the pipe, and within the zone of charcoal, a burnt clay sewer pipe is laid. This being porous, the gas escaping from the iron main finds its easiest escape into the sewer pipe; at frequent intervals escape pipes are carried from the sewer pipe to the tops of lampposts, where the leakage is burnt. It burns in a flame from three to four feet high. The Philadelphia Co. lays a double pipe; a small one, the high pressure, surrounded by a large one, a low pressure, which carries nothing but the leakage from the inner pipe. Dwellings are supplied from the outer pipe, mills and the like from the high pressure or inner pipe.

New Brazilian War Ship.

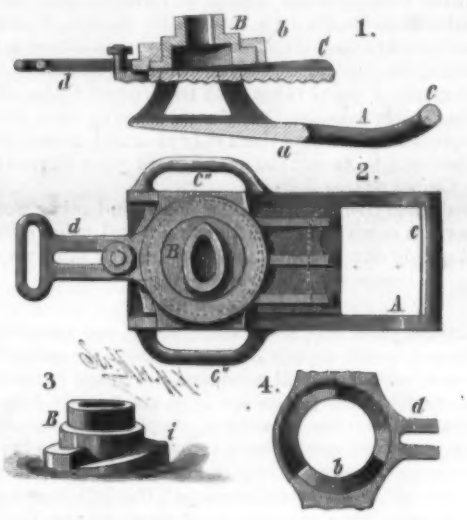
The Aquidaban, recently launched from Messrs. Samuda's shipbuilding yard at Poplar, is a twin screw armor-clad turret ship, 280 ft. in length, 52 feet in breadth, and 18 ft. draught, with a displacement of 4,950 tons. The estimated speed is 14 knots, with 4,500 indicated horse power. The hull is built of Siemens steel, and is divided into a large number of water tight compartments, the principal of which are the four boiler rooms and the two engine rooms, which are each separate water tight tanks, so that if either of them were flooded the ship could, at a reduced speed, proceed on her course with the remaining set of engines and boilers. The bottom of the vessel to a height 2 ft. above the water line is sheathed with wood and metal to prevent fouling; the stem and stern post, upon which the wood sheathing ends, being made of massive gun metal castings.



THE DAVEY SAFETY ENGINE.

TRACE OR HAME TUG BUCKLE.

In this buckle a clamping plate, or wedge and key, is employed for grasping and holding the trace, thus avoiding the necessity of making holes in the trace, as with ordinary buckles, and facilitating also the adjustment of the trace. Fig. 1 is a sectional elevation, Fig. 2 is a plan view, Fig. 3 is a side elevation of the cam or key, and Fig. 4 is an inverted plan view of the outer part of the frame. The main frame, A, is formed with a forward extension, *c*, for receiving the hame tug, side



DEIBERT'S TRACE OR HAME TUG BUCKLE.

loops, *c''* *c''*, for receiving the back strap and belly band, and the rear extension, *d*, the loop of which receives the breech strap, and the slot receives the stud of the clamping plate, C. The space between the face plate, *b*, and the back plate, *a*, is wedge shape to cause the clamping plate, C, to more firmly grasp the trace. The clamping plate is attached to the buckle by the stud passing through the slot, *d*, and is free to move longitudinally, so as to grasp traces of different thicknesses; the inner surface is corrugated, as shown in Fig. 1; it is also formed with ribs which act against the key, B, the form of which is shown in Fig. 3. The key is moved by a wrench applied to the head, and its movement is limited to about one-third of a revolution. When the key is turned in one direction, it will be forced inward against the clamping plate to grasp the trace; and when turned in the opposite direction, the trace will be released. This is effected by the cam surfaces of the key moving on those on the under part of the face plate of the frame, indicated in Fig. 4. This buckle will securely hold the trace without injuring it, and the wedging action will increase according to the draught upon the trace.

This invention has been patented by Mr. A. E. Deibert, of 585 McGee Street, Kansas City, Mo.

Iridium.

Iridium is a metal which is likely to have a much more extensive employment than it now enjoys. Hitherto it has been chiefly used in alloy with osmium for tipping gold pens. But an American pen manufacturer has discovered that by fusing the metal at a white heat and adding phosphorus perfect fusion could be obtained, with all the hardness in the resulting material of the iridium itself. For mechanical applications this combination is exceedingly useful, as in the case of pen points; and its adaptability is being proved in many ways. Agate, which has hitherto been employed for fine chemical balances, is now giving place to iridium, which takes a finer edge and is not so liable to catch or break.

Hypodermic needles for surgical use are now made of gold and tipped with the iridium compound, which is not subject to corrosion like the old steel points, and it is also being largely applied to instruments for surveyors and engineers and to electrical apparatus. Iridium can be obtained somewhat abundantly from the Russian platinum mines in the Ural, and it is found in combination with gold in California. Mr. Dudley, of Cincinnati, is engaged on experiments with the object of plating vessels with iridium, and as the metal resists the action of acids, it is likely that such vessels will be very useful in many chemical operations.—*Chem. and Drug.*

ECONOMICAL STEAM TRAMWAY.—The half year's working account of the Dewsbury, Batley, and Birstal Tramway, the first ever constructed in England, and worked by Merryweather 7 inch engines, shows the total cost of the running of the engines to be 2·57d. per mile, and the total expenses of the whole establishment, including locomotive charges, 5·16d. per mile. This is one of the most economically worked lines in England.

Trade with Mexico.

A correspondent writing recently from the city of Mexico to the New York *Sun* says:

Two half dollars, United States silver coins, containing 346 grains pure silver, are worth fifteen cents more than a Mexican dollar, containing 376 grains, an anomaly caused by the fact that United States silver coin is at par with gold. The Mexicans don't understand this, and consequently they hate Americans and prefer to trade with any other foreigners.

If the United States desires to have the good will of Mexicans and build up a trade with Mexico, it can be done quickly and simply by Congress enacting a law making the Mexican dollar receivable for custom duties, and giving it equal value with the United States silver dollar. Mexicans say they do not want to trade with a people who will allow them only 85 cents for their silver dollar, which contains 30 grains more pure silver than the United States dollar.

I suppose the people of Chili, Peru, and other South American countries producing silver, and using almost exclusively silver money, feel and talk the same way.

Cotton Seed Oil.

Several years ago, when there was a less number of mills and a full supply of cotton seed, the manufacturers of cotton seed oil were enabled to sell it from 35 cents to 47½ cents per gallon at a good profit, but, as capitalists who knew nothing about the operation of such industrial establishments were anxious to invest in schemes in which they thought thousands, if not millions, of dollars would be reaped, the mills were multiplied until there are now 117 of them in the United States, but principally located in the South. A large number were built along the Mississippi River from New Orleans to St. Louis, ten having been put in operation at Memphis alone. The competition which resulted in the demand for the purchase of cotton seed, and the difficulty of finding markets for the product, was made very apparent last year, when the price of seed advanced, and the price of oil fell to 30 cents per gallon, at which figure it has since remained.

Two hundred thousand dollars were sunk at Memphis last year in the manufacture of cotton seed oil, and when it was found that some of the mills would be forced to the wall, the necessity for a pool became so marked that all the mills from New Orleans to St. Louis were compelled to form it as a protection against inevitable loss.

Capitalists in Great Britain caught the fever, and six mills were built in its domain, and seed denuded of lint was sent in bulk from New Orleans to Liverpool or other English ports as cheaply as it could be transported from Nashville to New Orleans. Here was another competitive market introduced. Formerly cotton seed oil, meal, and cotton seed, were shipped from America, not only to England in large quantities, but to France, Spain, and Italy; the oil bottled, labeled as "olive oil," and returned to America for sale. The owners of English mills at the start-out imported cotton seed from Egypt, because there was only a small amount of lint at the end of the seed, the seed from America being covered with lint. This objection did not long remain, as the ingenuity of the Yankee was brought into play, and a process invented by which all the lint could be removed, leaving the seed as smooth and black as bits of tar. The same process has recently been adopted by the Huntsville Cotton Seed Oil Company, and has proved very successful. Many of the mills in the South have been forced to cease operations, partly for want of knowledge to run them and partly from the scarcity of seed of this season.—*Nashville American.*

Proposed Reduction of Newspaper Postage.

There are now before Congress four bills to abolish the postage on newspapers altogether. One was introduced by Mr. Townshend, of Illinois, another by Mr. Morgan, of Missouri, another by Mr. Dockery, of Missouri, and the fourth by Senator Blair, of which the *N. Y. Sun* says: "We see no satisfactory reason why the Government of the United States should frank this, or any other newspaper, while it continues to tax anybody for the use of the mails. We are against deadheading at the public expense.

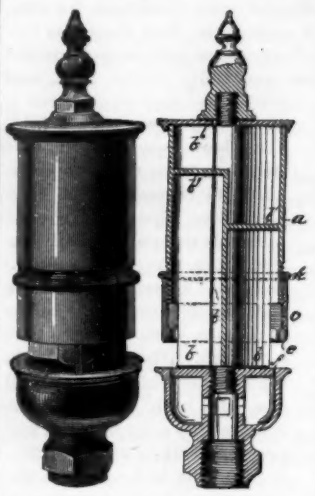
"There is a bill of a different sort before Congress which deserves more serious consideration. It was introduced by Senator Bowen, of Colorado, and it aims to reduce the postage on second-class matter from two cents to one cent a pound. We are glad to see that the Western newspaper men have decided to support the Bowen bill rather than to ask for a total remission of the postage on newspapers and other periodicals regularly mailed from a recognized office of publication. The reduction from two cents to one cent would be in line with the recent changes in the rates on other classes of matter, and would tend to secure a more equitable distribution of the cost of maintaining the postal service.

"Pass the Bowen bill. Let the deadhead bills alone."

To the above all good people will fervently say amen.

ADJUSTABLE SINGLE-BELL CHIME WHISTLE.

In the whistle shown in the engraving the bell, *a*, or upper part, is divided into three equal compartments of different heights; one of these is the full length of the bell; the second extends two-thirds the length of the bell, being cut off or stopped with an end plate, as shown in the sectional view; the third compartment is cut off so as to extend only one-half the length. These compartments form three separate whistles, and the length of each being different, each produces a distinct tone. As the lengths are properly proportioned, a musical and harmonious sound is produced, pleasant to the ear and yet penetrating and far reaching. The

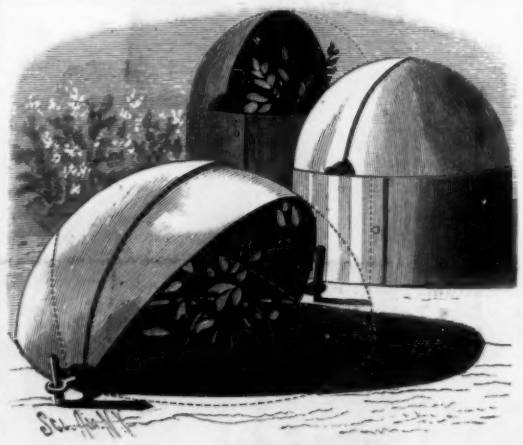


adjusting arrangement consists of a sleeve or band, *c*, covering the lower end of the bell, and so arranged that it can be brought nearer to or further away from the steam opening, as the case may be, with high or low pressure. For instance, if the lower edge of the bell should be too near the aperture admitting steam, the sound would be harsh, since the stream of steam would impinge on the edge of the bell with too much force; the adjusting band would then be screwed up so as to bring its edge away from the steam opening; or if the edge of the bell should be too far away from the opening, the sleeve would be run down. The sleeve may be moved up or down until the right focus has been obtained, and then secured by a check ring, *h*, placed above it. Once in the correct position, the adjusting sleeve will need no further attention. This whistle is applicable to locomotives, buoys, etc., and owing to the great distance the sound can be heard in foggy weather, is specially adapted to the use of steamers.

This whistle was invented by Mr. John Einig, and is now manufactured by the Crosby Gauge and Valve Company, of Boston, Mass. For particulars concerning the English and Canadian patents address the inventor, care Marine Engineers' Association, Jacksonville, Fla.

PLANT PROTECTOR.

The protector shown in the engraving, recently patented by Mr. William H. Brown, of Dunedin, Florida, is to be used as a covering for plants to protect them from heat, cold, rain, wind, etc. It is formed of two pieces of paper or sheet metal, having the shape of a pointed ellipse, each being so curved as to form a quarter of a hollow globe. The points of the sheets are provided with sheet metal strengthening plates. One section is placed within the other, and the two pieces are pivoted together by rivets which pass through the end plates. The rivets are formed with loops on the outer ends, through which stakes are driven to hold the protector on the ground. When the plant is to be covered,



BROWN'S PLANT PROTECTOR.

the protector is placed over it on the ground, and the sections arranged to form half of a hollow globe. When the plant is to be ventilated, one section is swung up more or less, and supported upon a piece of stone or wood placed beneath its edge. Either section can be raised according to the direction of the wind. When the plant is so high that it cannot be covered with the protector, the latter is placed upon a ring which is formed of two half rings pivoted to each other; this arrangement is shown in two of the figures in the engraving.

SOME one has said that the man who is curious to see how the world could get along without him can find out by sticking a cambric needle into a millpond, and then withdrawing it and looking at the hole.

Correspondence.

Straightening Old Grate Bars.

To the Editor of the Scientific American:

Your article of January 31, on "Draught of Boiler Furnaces," prompts me to communicate a fact that is not generally known, judging from the tons of old grate bars to be seen at the various junkshops, a large portion of which could be made as good as new. The bars, if not actually burned, can be brought back by heating the twisted portion to a very dull red, just enough to detect while in the fire; then nip the bar in a vise close enough to admit of its being shifted, bring a very gradual pressure on the other end with your hip, shifting the bar along so as not to take the warp all out at one place. With one heat I have taken three or four inches out of a bar. A very little beyond the right heat will cause them to break like old cheese. The degree of heat and gradual pressure that twisted the bar without breaking is the remedy to bring it back.

J. HARRY TAYLOR.

Philadelphia, February 2, 1885.

The Cause of Boiler Explosions.

To the Editor of the Scientific American:

Boiler explosions appear to occur fully as frequently as they did a year ago. On the 17th inst. a sawmill boiler at a small town in Pennsylvania exploded, killing five men; a few weeks since a boiler on a tug exploded here on the river, and a similar accident took place on a tug at Pittsburg a few days ago.

I have frequently had occasion to speak with some of the "engineers" who have taken an "active part" in some boiler explosions, and therefore venture a few remarks as to at least *one* cause why these calamities occur so often. I have discovered that in about five cases out of six the illiterate and uneducated man who has charge of a boiler believes it impossible to blow up a boiler, provided there is a sufficiency of water therein. These "engineers" will laugh at you when you question the working of the safety valve, or even hint that the iron might be torn asunder by a tremendous pressure of steam. With two gauges of water, they scorn the idea of bursting a boiler. (Two gauges is for them much safer than one!) One hundred pounds of steam on a five foot shell has no terrors for them if they *have water;* and should the engine lag on this pressure, they do not hesitate to screw or weight the safety valve, regardless of pressure or the condition of the boilers. These engineers are generally strong advocates of the "gas theory," *i. e.*, from some reason, usually low water, gas is suddenly generated in the boilers, and thus the explosion follows as a matter of course, and no one is to blame.

J. J. BOHN.

Chicago, Ill., January, 1885.

System for Steering Balloons and Maintaining a Desired Elevation in the Atmosphere.

To the Editor of the Scientific American:

Long before the experiments of Messrs. Renard and Krebbs had been made known (described in SCIENTIFIC AMERICAN, VOL. LI., No. 13), I devised a system of guiding elliptical balloons by the use of an electric current. This system, which was delivered to the Secretary of the Academy of Sciences of Paris, the 27th of August, 1883, No. 3,697, consists in an elliptical balloon inflated horizontally with gas to a suitable extent to almost balance the weight of the basket, the aeronauts, the motor, and the batteries, but in such manner that the basket should not be raised from the earth by the balloon proper, but should require a certain amount of power to lift it. The form of the balloon is that of a cylinder terminating in points at both extremities, thus offering the best possible resistance to the wind. Underneath, and extending its whole length, the balloon is provided with a sail which keeps it always head to the wind, like the tail of a windmill or weather vane. This sail acts as a sort of pivot in the air, and enables the balloon to be properly guided. The basket is provided with an electric motor connected with suitable batteries.

The motor works a horizontal propeller, which serves to impel the balloon forward and enables it to be moved out of the direction of the wind, if necessary. This propeller is movable on its axis, so that it can attain any desired inclination with reference to the sail. The motor also actuates a vertical stationary propeller situated between the sail and the basket, and which serves to raise the balloon either slowly or rapidly, or simply sustains it at a fixed elevation, according to the desire of the aeronaut. It is seen at once that this variation in the rotation of the propeller changes the ascensional force of the balloon, and sustains it at any desired height. Birds float in the air on the same principle. The basket is provided on its inner side with a semi-spherical parachute, which prevents the too rapid descent of the balloon. The guiding of the car is the most simple feature of the whole apparatus, it being necessary to raise it by mechanical power, on account of its being heavier than the atmosphere.

M. C. SENLECQ.

Ardres, France.

THE workingman's capital is health, and not wealth

THE MOTIVE POWER OF THE PHILADELPHIA CABLE RAILWAY.

(*Continued from first page.*)

a pinion rigidly mounted upon a shaft located parallel with the crank shafts, or up close to the pillow block, when it will engage with the middle pinion. (The engraving, Fig. 1, shows one crank pinion meshing with and the other disengaged from the intermediate pinions.) This movement is accomplished by means of a hand wheel mounted upon a screw threaded rod entering the end of the shaft. The second, or intermediate, shaft is mounted between the two flywheels, and carries two pinions of the same size as those upon the crank shaft; but the teeth of these pinions are made of maple wood, and are so held that they can be easily adjusted to take up wear, and in case of breakage a new tooth can be readily inserted. The main object in making these teeth of wood is to deaden the noise which would result from the use of an intermediate pinion of iron, since all the other pinions and spur wheels are of cast iron with file-trimmed teeth. So far, this method of construction has given the greatest satisfaction, the noise being hardly perceptible, and no wear being as yet apparent.

It will be perceived that either engine may be used to run the intermediate shaft, the position of the shaft pinions determining which shall do the work.

Extending across the rear of the engines is a 12-inch hammered iron shaft formed in two parts, each 12 feet 2 inches long. Upon one shaft is mounted a spur wheel, cast in one piece, 12 feet in diameter, 14 inches face, and having 107 teeth; upon the other is a spur wheel 9½ feet in diameter, 14 inches face, and having 83 teeth. These wheels engage, respectively, with the intermediate pinions. The larger wheel operates the cable running to Front Street at a speed of 7 miles an hour, and the smaller one that running to 42d Street at a speed of 9 miles an hour.

These are the only cables running at different speeds, the engines at the other stations being provided with two of the larger spur wheels. Upon each of the outer ends of these shafts are mounted two sheaves over which the cables pass. From what we have described it will be understood how either engine may be used to operate these shafts; but in order that either line may remain quiet while the other is running, each of the driving shafts is furnished with a crab-clutch coupling. This consists of a sleeve moving upon a feather, and so formed as to mesh with a rigidly mounted piece on the shaft when moved in one direction, and to be free when moved in the opposite direction. The weight and close fit, or more properly the stick, of this sleeve on the shaft make it a difficult job to move it, especially after it has remained in one position for some time. To obviate this a disk is rigidly mounted upon a short shaft journaled in a standard placed a little distance from the sleeve, to which it is connected by a rod pivoted at such a distance from the center of the disk that when the latter is turned about half way round, the sleeve will be moved its full distance. The opposite end of the short shaft is squared to receive the end of a lever bar by which the movement is effected.

Just back of the engine room are placed six compound tubular boilers, also built by Messrs. Wetherill & Co., each 48 inches in diameter, 14 feet long, and having forty 4-inch tubes. The grate surface of each is 20 feet; the boilers are arranged in three separate nests.

The two grooved sheaves upon the outer ends of the driving shafts are loosely mounted. An ingenious device for allowing for any inequality in the wear of the two wheels was designed by Mr. A. D. Whitton, chief engineer of the Traction Company. Each sheave carries upon the inner end of its hub a beveled steel wheel, 32 inches in diameter, and having 29 teeth. Between these wheels, and extending across the main shaft at right angles, is a steel shaft 6 inches in diameter, upon each end of which is a loosely mounted beveled pinion, 16 inches in diameter and having 14 teeth. These pinions mesh with the wheels on the sheaves. It will be seen that any difference in the speed of the two sheaves resulting from changes due to wear will be allowed for by this compensating device.

The cable, entering from the street, passes over the first of these sheaves, then around one of a similar pair placed a little distance away, then over the second, then to the other of the second pair, and thence around a sheave mounted on a car running along the pit, and then back to the street. The pit is 140 feet long, and the travel of the car sufficient to take up 280 feet of slack. (The course of the cable while in the building is plainly shown in Fig. 2.) The tension car is 17 feet 3 inches long, and travels upon a horizontal track of 4 feet gauge, laid along the sides of the pit. The rear end of the car is attached to a chain that passes over a pulley on a frame at the rear end of the pit; the end of the chain can be weighted to suit the requirements of the cable.

In a vault under the street, in line with the pit, are placed two sheaves—all the sheaves are 12 feet in diameter—mounted to revolve in such a plane that the incoming and outgoing portions of the cable will be led to their respective tracks. This is shown in Fig. 3.

Each station is furnished with a 10,000-gallon tank, thus making the company independent of the regular city water supply. At the Market Street station is an hydraulic elevator by which the cars may be raised to the second and third floors and stored during the night.

The cables are of steel wire 1¼ inches in diameter. The street tube, designed by A. Bonzano, C.E., in which they run—a cross section of the tube is shown in Fig. 5—was thoroughly described and illustrated in the SCIENTIFIC AMERICAN of June 7, 1884. It is formed of heavy boiler iron provided with vertical angle irons to stiffen it, and braced with angle rods extending from near the top to projections of the base. Upon each side is placed a backing of concrete. Extending along the top is a slot ⅝ of an inch wide through which the grip standard passes. In order to prevent the sides of this slot being forced together by the action of frost, ties 3½ feet long and made of 5 by 7 inch timber extend from the sides of the tube above the concrete backing. The stringers rest upon these ties. Seven-eighth inch tie rods extend from the top of the tube to shoes on the ends of the ties. By moving the nuts on the ends of these rods, the width of the slot can be adjusted. In the lower part of the tube the small pulleys carrying the cable are mounted.

The cables cross each other at five different points. At these places the grip of the car on the under cable is detached, the momentum of the car being depended upon to carry it by the crossing; cars upon the upper cable, of course, pass without freeing the grips. The cables are so deflected by the arrangement of the pulleys as not to interfere with each other. In passing around curves—the standard curve is 35 feet 7¾ inches—the pulleys in the tubes are placed horizontally, and the slot is located so as to form a circle concentric with, but a little larger than, that formed by the outer edges of the pulleys. This permits the grip to pass freely by the pulleys, the cable moving in the circle described by the slot and grip.

The grip—of the Low & Grim's patent, San Francisco, and built by Messrs. Robt. Wetherill & Co., of Chester, Pa.—consists of a wide bar, 1⅛ an inch thick, at each side of the lower end of which is a grooved pulley for raising and guiding the cable between the two grooved bars (shown in Fig. 5), placed parallel with the cable, and which constitute the grip proper. The jaws are so placed as to prevent undue wear upon the cable. These jaws are operated to press the cable between them, or to release it from the platform of the car, the gripping being effected through a plate sliding vertically in the center of the grip shank.

Within the stations the plant is in thorough working order, and as but little remains to be done to complete the street portion of the system, it is expected that all the lines will be in operation in a few weeks.

Advice to Young Engineers.

A good many engineers will undoubtedly recognize some of their own early experiences in the engine room when they read the following, from a correspondent in the *American Machinist:*

When business is depressed, the manufacturer thinks he must get along with a young man or boy in the place of a competent man, and the following is the result:

They discharge their engineer, and in his place put a young man who has served a short time as wiper in another place. He can oil and wipe an engine, knows how to pound with a hammer and twist the corner off nuts with a wrench, and that is enough until times are better. No sooner is he in the engine room than he considers himself quite an engineer. Because the engine does not happen to break down the first week, he gets an idea that he is an old hand, and a desire comes over him to see the inside of the engine. So at the first opportunity he pulls it to pieces, placing part of it on the floor, some on the cylinder, and some on the bench, strewing it generally about the engine room; all small nuts, keys, or screws he happens to have he puts in one of his many pockets.

Now, young man, the trouble commences. Objects that were familiar to you look strangely different now, as they lie strewn about the room. But together it must go, so you begin with the steam chest. Where did you put the bolts? Oh! here they are, in this pile by themselves, so they would not get mixed with any of the others. That is nice, no doubt, but when you go to put them in, one goes in with the use of the fingers only, while another requires a long wrench. What is the matter with them? They came out easily. The matter is simply that little pile. Now that you have the bolts all started, you begin at one point and screw them up tight as you go along, so as to know where to leave off. Queer some older head didn't think of the same thing.

Where are the valve rods? In a pile by themselves also. But which is which? I don't know, but will try them and see. This one goes on hard; give me my hammer. Now you exhibit the one thing that you can do and do as well as any one, and that is, pound with a hammer (don't use a block of wood, for in time you would be certain to destroy the block).

One other thing you know ought to be done, and that is each individual piece should be carefully wiped and the waste deposited—well, on the floor is the handiest place. You pick it up and wipe a piece with it, lay it down, roll it over, and step on it until it finally becomes well mixed with grease and grit, but it is waste, and that is enough.

Let's see; how far did I run this nut back on the eccentric rod? Well, two or three times, more or less; it don't make much odds.

You have it together at last. It came apart easy enough, but it went together very hard.

Now is the great moment in your life. You have had an engine apart and put it together all yourself, and are about to start it. Finally you get on steam enough to get it up to speed. What is the result? It pounds, squeaks, groans, and heats. What is the matter? Simply your incompetency.

The bearings are all full of grit from the dirty waste; some parts you oiled and some you didn't. You mixed up the valve rods, keys, and screws. You did not get the nut on the eccentric rod in the right position. In fact, you forgot a thousand and one little attentions necessary to have an engine run properly, which a man who has learned his trade will not forget.

Now, young man, first of all, let well enough alone. Never disturb an engine without occasion demands it, and if so, do it systematically. Have the floor swept clean, and spread some old sacking which is clean. When you take a part off, clean it with clean waste, being careful to keep your waste from all grit. Run your hand over the part to see if the waste has left anything on it, as the hand will readily detect the smallest particle of grit. After you have cleaned a part, lay it back out of the way just as it came off, and all the small stuff with it, just as it belongs.

When you take off the head or steam chest, take the bolts and lay them in a circle or hollow square, with the small ends in, so that you can put them back just as they came out. You will be surprised to see how much faster the work will progress.

When you come to a thing that sticks, find out what causes it, and remedy it. The builders of steam engines do not always do their work well. But whatever you do, don't use a hammer; use wood or lead tools to pound with. If you use blocks, cut them about 5 inches long and 8 inches in diameter, of hard wood, keeping them on hand all the time, replacing them as fast as one gives way, never waiting until needed.

When you put a wrench on a nut, see that it fits it before you begin to pull, or you will soon spoil both wrench and nut. If a nut goes too hard, take it off and clean the thread.

If your oil can gets stopped up, look out for it, as it does no good to stick the snout of a can into an oil hole unless you leave a drop of oil there.

Empty out both your can and filler and wash them out clean, then get a piece of thin cotton cloth and strain the oil; it will not take long, and you will be sure of the can's delivering a drop of oil every time it is required. And, lastly, when your engine runs bad, sit down and try and reason out why it does so. And take a good paper to read.

The Square in Battle.

Lieut.-Gen. Sir Edward Hamley, of the British Army, is strongly opposed to the tactics adopted by the troops of forming squares in battle. He argues that unless the front rank is lying down, a position it could not maintain when the enemy comes close to the sides attacked, it delivers a fire small in proportion to the number of rifles, while the sides not attacked deliver none. Should the square be penetrated, then it becomes a mob, because the recoiling troops are pressed back on the other forces. The troops forming three sides of the square have their backs to the enemy who have succeeded in getting inside, and such of the men as face inward to meet the attack cannot fire on the enemy without also firing into the opposite side of the square. He thinks it desirable to ascertain how far the losses in the late action were caused by the English fire during the *melee*. When the whole brigade is placed in a square, the chances of disaster are immensely increased, as the sides of the square are under different regimental commanders, unaccustomed to act in such close association, while the extent of the space occupied renders it difficult for the brigade commander to convey with sufficient promptitude the orders necessary to insure an *ensemble*, even in movements of a simple kind, and impossible to effect a good formation when engaged with an enemy in a much better formation, such as echelons, or half battalions, or even double companies.

THE completion of the Mackey-Bennett cable makes the total length of submarine cable, according to the *Electrician*, about 68,000 miles. Each cable contains an average of 40 strands of wire, so that altogether there are over 2,500,000 miles of wire used in their construction, or ten times the distance from the earth to the moon. Practically all of this has been laid within the last twenty-five years; the greater part within a decade.

RECENT PROGRESS IN ELECTRICITY.—THE PHELPS SYSTEM OF TELEGRAPHING FROM A RAILWAY TRAIN WHILE IN MOTION.

The public prints give us almost daily accounts of railway collisions in one section of the country or another. Every effort has been made to avert these. The general introduction of the telegraph has unquestionably done much in this direction. But in thick weather the operators at the railway stations could scarcely be looked to to guard points of the road beyond their ken, and the railway switchman or signalman, like his even Christian in other walks of life, is fallible. If railway signalmen could be found who required neither sleep nor rest, who were not subject to fits and spasms, nor spirituous excesses, and, above all, having eyes to pierce a fog, then railroad travel would, indeed, be divested of its greatest terrors. But, taking human nature as we find it, we learn that so grave a responsibility as the care of human life should never be thrust upon the shoulders of a single man. The "block" system recently introduced would, it was believed, prove a reliable means of preventing accidents on the rail, and it is but fair to say that it has made an excellent record. But that it is not, under all conditions and circumstances, to be relied upon there is abundant evidence. Only last week it failed to prevent a collision between two freight trains at New Brunswick, N. J., on the line of the Pennsylvania Railroad, in which two lives were lost and property to the value of half a million dollars destroyed. It was, of course, only by mere chance that these trains were not carrying passengers.

From this it may be inferred how pressing is the demand for some system in which the safety of the traveling public is not made to rely upon an unthinking and not always reliable automaton, or, still worse, upon the action of an overworked and irresponsible employe, whose perception of colors may be defective. Many able electricians have believed the solution of this problem to lie within the domain of electrical science; and those who have followed the drift of recent electrical endeavor are aware of the number of contrivances, all looking toward the same goal, that have made their appearance. The general principle on which all these have been based was electrical communication between all trains while *en route* and the train dispatcher. Most of these systems have shown a certain degree of efficiency when tested under favorable conditions, but the best of them were subject to interruptions, and this, from the very nature of the work they were called upon to perform, rendered them more or less uncertain, owing to the fact that they relied upon a direct contact with the conductor, either by wire, wheel, or brush.

Mr. Lucius J. Phelps now comes forward with a practical system of train signaling which does not rely upon contact at all, the electrical induction coil upon the moving train being distant from the conductor lying between the track at least seven inches.

Mr. Phelps would seem to belong to that class of men who have made America famous for mechanical ingenuity. These men never accept anything as a fact in natural law without first demonstrating it to their individual satisfaction. They rarely follow where the crowd leads unless the goal is really in sight, and when they do strike out into new paths, and continue their investigations, they may confidently be looked for at the finish.

While others were looking for an efficient system of intercommunication between moving trains and the train-dispatcher by an electrical circuit closed by contact, Mr. Phelps sought it by means of a utilization of that bugbear of underground telegraphy, "electrical induction," and he found it.

We herewith illustrate his system, and the reader will, perhaps, be surprised that such a valuable service may be performed by so simple a contrivance, for it is little more than the utilization of the principle of induction by means of the ordinary telegraph apparatus in a modified form. It is designed not only to keep the train dispatcher apprised of the condition and whereabouts of every train on his division, but also to enable him to acquaint every conductor of a moving train with the movements of the trains immediately before and behind him. This results in making seven intelligent men responsible for the safety of every train—the train dispatcher of the division on which the train is running, the conductor and his operator, the conductor and operator of the train in front, and the conductor and operator of the train behind. Of course this system will perform its most important duty during thick and foggy weather and at night. But even during the day, when running through tunnels or around curves, it cannot fail, if adopted, to be of invaluable service; and the absurd and slovenly practice of sending a brakeman down the track in foggy weather to flag or signal a coming train would happily be discontinued.

There are other uses to which this system can be put: the sending and receiving of dispatches from and to the passengers on a through train, for it operates like any other telegraph system. This part of its work, however, sinks into insignificance beside its real and proper function of averting disaster.

Just how the idea of utilizing the induction principle came to suggest itself to the mind of the inventor is interesting.

For some time past, especially since the burying of electrical wires and mains was seen to be imperative, a host of electricians have been devoting themselves to the study of induced currents and the consequent retardation. While a world-wide discussion as to the cause of this and similar phenomena was engrossing the minds of his confreres, Mr. Phelps, with admirable sagacity, bethought himself of making some use of what all were trying to guard against; and before he had gone very far with his investigations, he discovered that what made underground electrical transmission uncertain and costly was the one thing needed to make station and train intercommunication practicable.

In order to understand Mr. Phelps' invention it is necessary for the general reader to bring to mind a familiar example of electrical induction. "If two wires are extended parallel, near but not touching each other, and we send a current through one, a momentary current is excited in the other wire, opposite in direction to that flowing in the first."

This phenomenon forms the basis of Mr. Phelps' invention. He arranges a telegraph wire in the center of the railway track; attaches another wire to the bottom of the railway car, with which wire he connects a telegraph sounder located within the car. Whenever an electrical signal is sent through the track telegraph wire, it produces by induction a corresponding current in the wire attached to the car, and this current works the sounder, thus delivering the message. It matters not how fast the train may be moving, if the wire on the bottom of the car is brought within a short distance of the telegraph or track wire, any strong electric impulses, such as telegraph signals, that are passing along the track wire will be taken up by induction by the car wire, and delivered by the sounder, and, *vice versa*, when the operator on the moving car operates the lever of his telegraph instrument, and sends electrical impulses or messages through the wire that hangs below the floor of the car, these impulses will be taken up by induction by the track wire, and conveyed to the sounding instrument of the railway station. The diagram, Fig. 2, shows the electrical arrangements for this purpose.

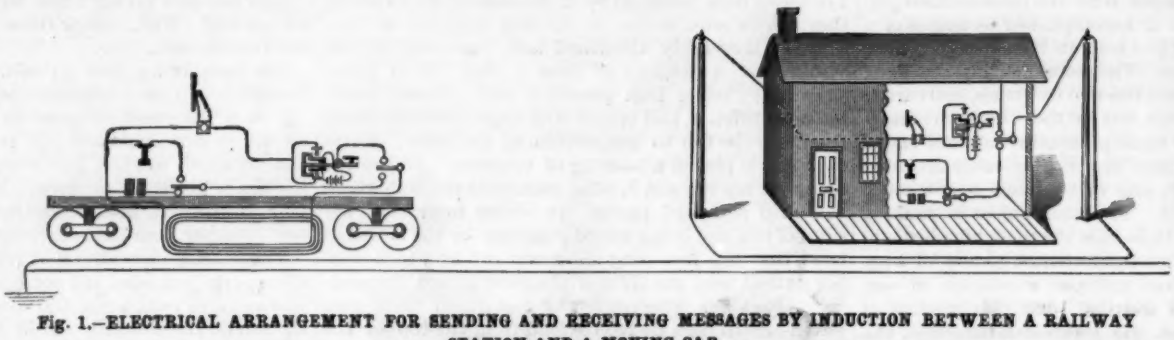


Fig. 1.—ELECTRICAL ARRANGEMENT FOR SENDING AND RECEIVING MESSAGES BY INDUCTION BETWEEN A RAILWAY STATION AND A MOVING CAR.

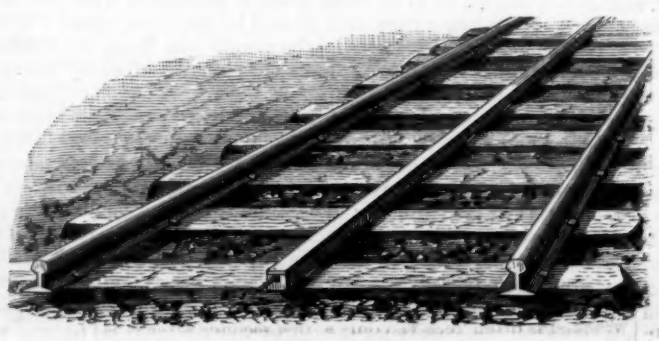


Fig. 2.—THE TRACK TELEGRAPH WIRE.

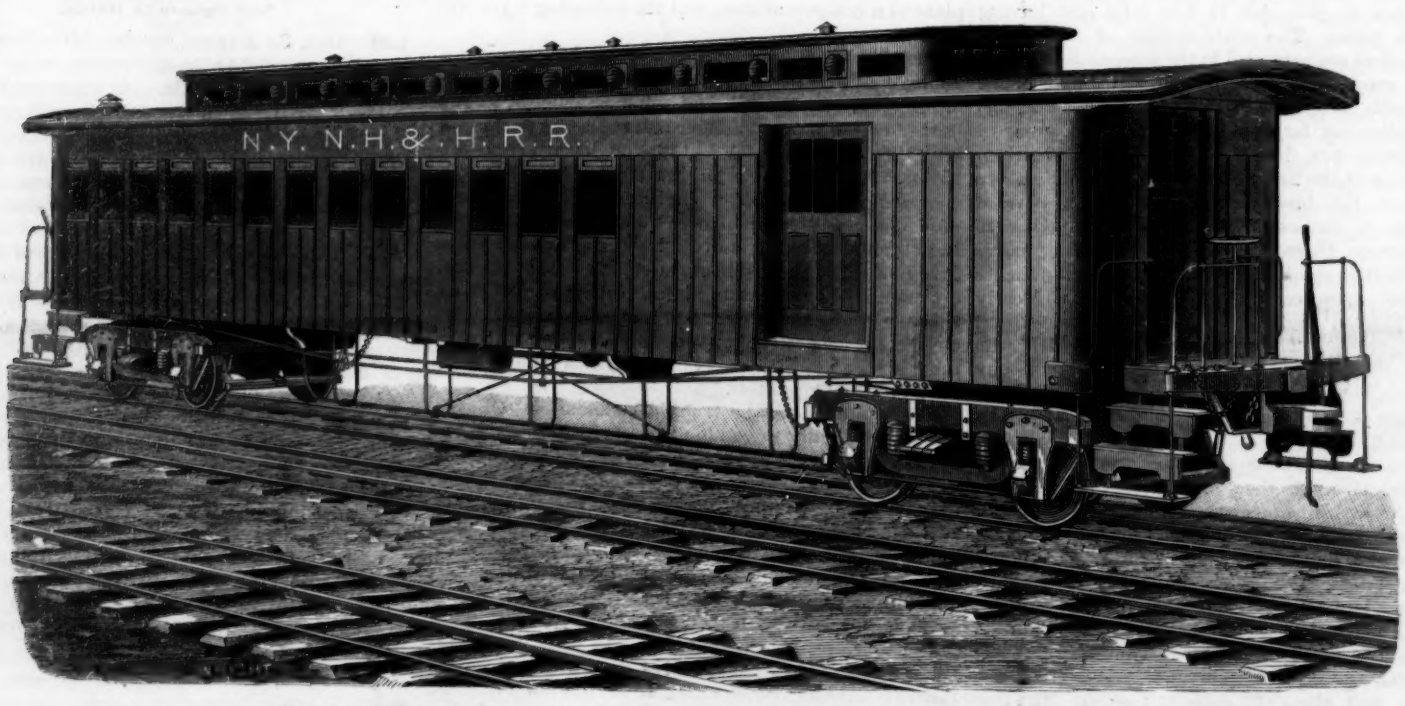


Fig. 3.—INDUCTION COIL SUSPENDED BELOW THE BOTTOM OF CAR.

We will now briefly describe the actual construction of apparatus used by Mr. Phelps on the New York, New Haven, and Hartford Railway, over a section of that road twelve miles in extent.

The conductor or track wire, whence the induced current originates, is placed by Mr. Phelps at a point equidistant from the rails over which the cars pass. This conductor, a No. 12 American gauge insulated wire, is incased in a wooden box, two inches square, having a groove in the top, three-eighths of an inch square, as shown in Fig. 2. Over the wire is nailed the box covering, having as a protection for its joints a strip of galvanized wire. The wooden box containing the conductor does not rest directly upon the ties of the track, but on blocks of wood, four inches long, two inches wide, and thicker or thinner according as the ties are higher or lower in the center. The ties on a railroad being rough-hewn, the placing and fitting of these blocks requires care; and in order to facilitate the work of placing them, Mr. Phelps has designed an apparatus which, manned by four men, will fit and lay two miles of these in a day's work, and with such nicety that the top of the box containing the conductor will be a trifle below the same plane as that in which the top of the rails lie. At points where branch or other roads cross the main line, the box containing the conductor is brought up to within an inch or two of the intersecting rails, and the conductor, forsaking its wooden protector for an India rubber one, passes under the interfering rail, and coming up on the opposite side again enters its box, being guarded for a short distance by India rubber tubing.

Where a high-road crosses the track, the conductor passes into an iron pipe, which in turn is sunk into the wooden roadway and below its surface level. At points where the track is being repaired the ties are removed, by slipping them from under the little blocks.

The electrical arrangements on the car are as follows: Running the entire length of the car between the forward and rear trucks is the induction coil. There is a two inch gas pipe, which is suspended so as to hang seven inches above the track conductor, that rests upon the ties. Within this suspended gas pipe is a 1¼ inch rubber hose, which in turn contains ninety convolutions of No. 14 copper wire, insulated with paraffine. This copper wire extends round and round through the suspended gas pipe and up along the upper part of the car, and forms a circuit a mile and a half long.

The pulsations which pass over the track wire when taken up by the induction coil suspended below the car are received or materialized by an ingeniously made polarized relay instrument invented by Mr. Phelps, the general form of which will be seen in Fig. 4. We will not attempt here to describe its exact construction. It will be sufficient to say that its distinctive characteristic is its successful operation under the influence of very delicate electrical impulses, the readiness with which it may be adjusted, its non-liability to get out of adjustment when once set at work. The hammering and jarring of the car when traveling over the road does not interfere with the certain and regular operation of this remarkable relay receiver. From this instrument the received impulses are conveyed to an ordinary telegraph sounder, worked by battery, and thus the delicate movement of the receiving relay is translated into loud sounds, so loud if desired as to be heard in every part of a long railway car, above the rumble and roar of the train.

The new electrical apparatus, as now in use on the N. Y., N. H. & H. R. R., is located in one corner of the baggage car. It is represented in Fig. 5. Only a small battery of twelve cells is employed. An ordinary Morse telegraph key, sounder, battery, and Phelps instrument constitute the outfit.

The Phelps Induction Telegraph Company have set up their plant on a section of the New York, New Haven, and Hartford Railroad connecting the Harlem River with New Rochelle Junction—a line about twelve miles long. Of this length about three miles are trestlework. It crosses two rivers by draw-bridges; one of which requires 110 feet of cable, and the other 175 feet. In order that the test should be a thorough one, the wire is carried 26 times under the track in the manner already described, and there are 47 places where the public highway crosses the track, and hence where iron tubing must be used for the track line. At the beginning of the line, viz., at the Harlem River station, the wire is returned upon two side tracks, while at the end of the line it is supported for a distance of half a mile upon poles in the ordinary manner. There are twelve stations on this section, and hence, if we except length, all the conditions are present which might be looked for in the average railroad.

Private trials of the apparatus established on this line have been made almost daily for nearly a month back, and the results must have been very pleasing, not only to Mr. Phelps, the inventor, but also to the company which has been organized to use his patents. The inventor has had the satisfaction of practically demonstrating all that he has ever promised for his system. The train with ten invited guests left the Grand Central railway station in the N. Y. & N. H. R. R. at 3:02 P. M., and was soon at the Harlem River, the southern terminus of the experimental line. Telegraphic communication is constantly maintained between the train, running at times about 40 miles an hour, and a main office in the line representing the train dispatcher's office.

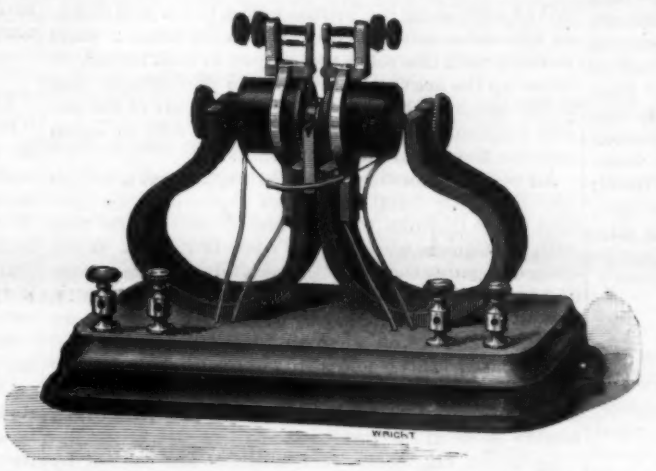


Fig. 4.—PHELPS' NEW RECEIVING RELAY.

The facility with which messages can be sent backward and forward over a line constantly increasing or lessening may be said to differ in no respect from that usually experienced in any well appointed telegraph office, and there is absolutely nothing, save the noise of the flying wheels and the shaking of the car, to indicate that any unusual means of telegraphic intercommunication is being tried.

The many and various commands usually coming from a train dispatcher's office are sent and received; and in order to demonstrate that the time necessary to send a message by this system is neither longer nor shorter, but precisely the same as that required to transact business between stationary offices, the time of some of the messages is appended, and referred to a watch that was made to correspond with the one at the permanent station. The warning signal from the dispatcher's office that the train ahead is wrecked is often received only a few seconds after it is sent, and the train is brought to a standstill at once. Then the conductor is notified that the track is clear, and to increase his speed, and so on.

The Phelps Induction Telegraph Company has frequently invited to witness these experiments those who have expressed a disbelief in the success of any and all systems with a view of intercommunication between trains *en route* and the dispatcher's office. The skeptics now, since they have seen a practical demonstration of the system, are likely to prove its warmest supporters.

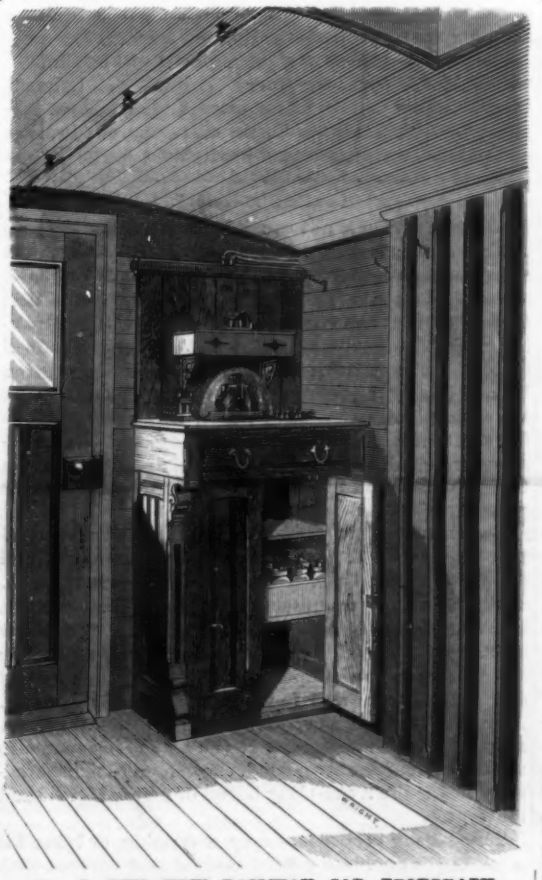


Fig. 5.—THE NEW RAILWAY CAR TELEGRAPH APPARATUS.

That part of the apparatus which very justly attracts the most attention from the electricians is the instrument which Mr. Phelps has devised for receiving. In the arrangement for transmitting, the terminals of the coil are brought to the ordinary telegraph instrument, and, by means of the back contact of the instrument, to a very delicate polarized relay. This relay, a very important part of the apparatus, is intended, of course, to serve a certain purpose. In its capacity of receiving instrument it responds instantly to every reversal of the polarity of the current over the conductor running along the ties below. The sounder in ordinary use is employed, being worked, as usual, by the relay. One of the five cells of the battery is employed to operate the sounder, and the balance in the transmission of messages. The current goes through the front contact to the key, traverses the labyrinthine coils, and operates the "buzzer," this serving to break the current quickly. The humming that ensues is made up of the characters of the Morse alphabet, and at the terminal station is interpreted through a telephone receiver.

The noise of the train, which some scientific skeptics have insisted would prevent the reading of the telegraphic signals as they come over the wire, does not in actual practice interfere with the reception of messages; and it is readily apparent that whatever defects may possibly appear in the future, there never will be any trouble whatever in hearing the signals, as they come out clear and distinct, being readily understood from the furthest end of the car.

It should be explained that this twelve mile section traversed, viz., from the Harlem River to New Rochelle, had been made as near as possible to represent a section of any road. There are culverts to be crossed, and ditches and elevations, and running streams.

On all well organized lines of railway a train dispatcher has charge of a certain section, usually a hundred miles long, and the system is considered as approaching nearest to perfection where the dispatcher is oftenest apprised of the position and condition of every train in his section.

In the trials on this line the dispatcher is kept momentarily apprised of the movements of the train. This system the Phelps Induction Telegraph Company claims to be able to maintain on any railroad, and their frequent experiments prove that they can support the claim in actual practice.

A curious and interesting phenomenon was observed by Mr. Phelps while recently experimenting on this line, and is here given as he himself described it: "About a mile distant from the Harlem River station there is a trestle, the up-track of which is undergoing repairs, and the wire, for that reason, was taken over to the down-track and carried across the trestle on insulators below and to one side of the center track, so that as the car carrying the coil of wire passes down the track the parallel wires upon the car are fully *four feet* from the conductor below. Out of pure curiosity Mr. Phelps directed his assistant at the terminal station to listen at the telephone while the car was crossing the trestle. When he reached the station, his assistant, much to his surprise, told him that he had read the words distinctly, and repeated the message which Mr. Phelps had sent off while the train was on the trestle."

During an official trial, a few weeks since, the following telegrams—perhaps the first ever sent to and from a moving train—passed between the inventor of the system and the conductor of the train, the one at a terminal station, the other on the road:

ON THE ROAD, MOVING AT THE RATE OF 40 MILES AN HOUR,
January 27, 1885.

To LUCIUS J. PHELPS, Harlem River:

Accept congratulations from the employes of the N. Y., N. H. & H. R. R. upon success in your great undertaking.

(Signed) H. A. CONLY,
Conductor on Train No. 15.

January 27, 1885.

To H. A. CONLY, *Conductor Train No.* 15:

Your message of congratulations received. Accept thanks. This is the wedding day of the Electric Telegraph and the Limited Express—the two rapid means by which the world moves to-day. The man who neglects to use them both gets behind.

(Signed) L. J. PHELPS.

The future possibilities of these new inventions of Mr. Phelps appear to be very great. Just how far the system can be extended and applied it is impossible to foretell. But this appears to be certain: the risks of disaster on railways will, by this means, be greatly reduced from this time onward.

ACCORDING to some of our medical journals the use of mullein as a palliative for the cough of phthisis seems to be meeting with favor in various quarters. The customary form of administration has been a milk decoction of the plant. More recently the smoking of the leaves has been recommended as a more agreeable and effective method of administration.

Practical Method of Transferring and Coloring Photographs on Glass.

Mr. W. M. Ashman, in the *Photographic News*, gives the following interesting details about the art of transferring and coloring photographs on glass, which has within a recent period been introduced under various names as the ivorytype, the Romantype, etc.

The mounted photograph is removed from the card by immersing in water until the paste sufficiently softens to permit the print to be carefully removed without injury. Remove all paste from the back of the unmounted print, and trim a little smaller than the size of the glass to be used; rub the albumen side gently with a piece of linen rag dipped in benzoline as supplied at the oilman's, plunge into warm water, and after two changes blot on a clean towel; place the albumen side upward on a hard flat surface (a piece of plate glass), and apply the mounting solution or paste all over it.

Mounting solution is composed of:

French gelatine	20 grains,
Water	1 ounce,

to which is added an alcoholic solution of salicylic acid five drops; this requires warming up a little before using.

For mounting paste, use French gelatine, 20 grains, dissolved in water, one ounce; to this add an equal volume of ordinary starch paste and a similar quantity of Kingsford's Oswego blancmange, and twenty drops of an alcoholic solution of salicylic acid as an antiseptic; heat the above ingredients over a water bath for a few minutes, stirring the whole time; when cold, it is ready for use. To a previously clean convex glass apply some of the same mountant as used on the print all over the inside surface, then lower the print, albumenized side down, gradually on to the inside of convex glass. It does not require any great amount of skill to do this without blisters or creases; but, if such should occur, it may be easily withdrawn and mounted afresh. Well squeegeeing, to remove excess of paste, is the next operation, after which it may be placed on end to dry spontaneously, which will take from six to twelve hours according to the temperature. To make a squeegee, procure a strip of rubber composition about one-eighth of an inch in thickness, cut one edge to fit the bevel of large plates, place a strip of wood on either side, and screw all together, leaving about one inch out on the beveled side. No squeegee will be found necessary when small plates are used, any excess being more easily removed by the fingers.

When the photograph is quite dry, place it on a cushion, and rub the paper away with fine glass paper, working gently in a circular direction, the object being to get the photograph as thin as possible, and thereby more easily permeated in the next operation; but care must be taken not to grind off all the paper.

There are several substances suitable for rendering the prints transparent, but the writer has found as good as any a mixture of:

Canada balsam	5 ounces.
Solid paraffine	2 "
White wax	2 "

Melt at as low a temperature as possible, then place the picture therein, keeping the composition in a molten condition either in a slow oven or on a water bath. If a high temperature be maintained, the print will lose its whiteness, and, when painted, will appear somewhat bilious. At the end of an hour the picture should be examined, when, if it is quite transparent, it may be removed, and when cool enough the excess wiped off. If, on the contrary, opaque patches are still visible, it should be allowed to get cold, then rubbed down a little more with glass paper, and again put into the wax composition, allowing it to remain until the marks disappear. When cold, rub off all excess, and proceed with the painting.

The writer was shown some pictures treated as above, but the painting was performed with a shilling box of water colors, and though so little had been done, it was really surprising what a pretty effect it had. To overcome the difficulty of putting water color on such a repellent surface, a friend said he had used shellac dissolved in borax as a medium to mix the colors; he then found no difficulty in working in any way he pleased on the print, while, for the back glass, water answers equally as well as on colors; but this class of picture seems to lend itself particularly to oil colors.

Having prepared the photograph, the next thing will be to describe, as concisely as possible, the operation of coloring. The glass supporting the photograph should be laid on the retouching desk, concave side upward, and the most important points noted. These comprise such things as the eyes, lips, high lights, hair, flowers, jewelry and small details, etc., for they must be all colored on the back of the photograph. It is recommended that the beginner paint in the hair, flowers, and jewelry, before attempting the eyes, for they will be found more difficult than any other part of the process. Mix a little each of Naples yellow, Indian yellow, and poppy oil for very light golden hair; burnt sienna and poppy oil for brown hair; and black, Vandyke brown, and poppy oil for very dark hair. Linseed and boiled oil may be used for the purpose instead of poppy oil; but the latter will be found to answer every purpose.

Having applied the paint to the hair, turn the glass round to see the effect; also whether the whole surface has been covered or not. Should it have been satisfactorily performed, the lips and cheeks may be done next. They should be painted with a mixture of vermilion and carmine in the following manner: Run a line of color along the surface with a brush well charged with color, softening it off with a dry brush; while working with this color, put a spot in each nostril, to warm up the heavy shadows in the photograph—also in the corner of the eyes, and any other part of the picture requiring that mixture. It will be well to again examine the picture from the front.

All being satisfactory, the eyes may be next attempted. Paint the pupil with pure black, and the light spot in the iris with Chinese white. Mix a little blue with the Chinese white for the white of the eye. When quite dry, paint the iris with a mixture of ultramarine and poppy oil for deep blue eyes; mix black, white, and ultramarine for gray eyes; and for dark brown eyes use Vandyke brown with black, using poppy oil in each case. If the colors are not strong enough, they may be strengthened; but the first must be allowed to get quite dry before the second application, otherwise a muddy effect will be produced.

Eyebrows, mustaches, and whiskers are colored by laying on the color sparingly, and softening off with a dry brush. There should be just enough color laid on to do this nicely, because too much will look harsh, and not enough tends to flatten the picture.

Paint the jewelry in solid color, using, for gold, Indian yellow, Naples yellow, and vermilion; for silver, use Chinese white and black.

Lace should be touched up, the lights with Chinese white laid on thickly, and the shadows with gray composed of black and white. When the colors are dry, attach the second glass by means of gummed paper. Mix Chinese white with all the colors to render them opaque, and apply them roughly over the surface, no part of which should be left uncovered. The flesh color is composed of Naples yellow, vermilion, carmine, and Chinese white, thickly laid over the flesh parts, deepening the cheeks, if necessary, with vermilion, the shadows with a slight admixture of ultramarine, according to the subject. Dresses will in many cases be left to the taste of the operator; and in painting them it must be borne in mind the sort of background that is intended, for harmony must prevail where large surfaces—such as backgrounds and dresses—are treated. Otherwise, however nicely the flesh and other details may have been executed, if the larger surfaces do not agree, the result must be considered a failure (loud, in fact). Any work put on, if found afterward to be unsatisfactory, may be easily removed with rectified spirits of turpentine on a piece of linen rag, and the same substance will be found useful for cleaning the brushes, finishing them in a little methylated spirit.

The principal tubes of color required will be Chinese white, black, Vandyke brown, chrome No. 1, burnt sienna, Naples yellow, ultramarine, Indian yellow, carmine, vermilion, also a bottle of poppy oil; brushes and palette, turpentine, and methylated spirit.

Coating Metals.

Galvanized iron is not usually submitted to the galvanic battery; it is iron coated with melted zinc, just as iron is coated with melted tin to produce tin plate. Sheet or plate iron can be put into all the forms that galvanized iron can be made to assume, for the galvanizing, or coating with zinc, does not change the radical characteristics of the iron. The object of the coating by zinc is only to preserve the iron from oxidation by the atmosphere, acids, clear water, and water containing acids and salts. For some purposes—art ornamentation principally—a coating of zinc is precipitated on iron by oxide of zinc in sulphuric acid deposited in the usual way by electricity.

But ordinary zinc coating is produced in a much simpler way, and it is not confined to unmanufactured sheets, or even to thin iron; castings, forgings, rods, chains, and many manufactured articles are zinc coated by immersion in a bath. The material to be coated is chemically cleaned by a bath of sulphuric and nitric acids and water in proportions of one by measure of each of the acids and four by measure of the water. A previous dipping in strong lye, if the article is greasy, may improve the process. If the articles cleaned are not to be immediately coated, they should be mechanically cleaned in a tumbling barrel or scoured with sand and water.

The coating proper is simply a dipping, or lying for a minute or two, in a melted bath of zinc covered with powdered charcoal. The article is rapped with a mallet, or if small, like rivets or chains, is thrown against a sheet iron screen, to separate loosely clinging particles of zinc, and the work is done.

Thin brass articles, as kerosene lamp trimmings and the parts of chandeliers and lamp brackets, have a glossy varnish on them that is not japanned, nor is it a lacquer; it is really as durable as either, and is much cheaper. Without it these polished brass articles would soon become green with oxide and defaced with blotches. This invisible varnish is simply bleached shellac dissolved in alcohol; but the alcohol is burned off, leaving only the film of the gum. For lamp tops, as an instance, a boy takes a bunch of them strung on wire, dips them in a tank of shellac varnish, swings them out, and touches them to a gas flame. Instantly all is ablaze, and after waving the bunch back and forth half a minute, the blue flame burns out and the job is completed.

Laying Down a Rule of Life.

A thoughtful writer in the *Herald of Health* observes: "It really seems sometimes as if hygienic science were all wrong, and as if late hours, much hard work done under the gaslight, and the smallest amount of fresh air were the way to be healthy, if not wealthy and wise. Who lives under more unhealthy conditions than our legislators or the leading counsel learned in the law? But our statesmen are in a green old age at 75, and lawyers are quite boyish at 60; so, too, are actors and actresses." Our contemporary then goes on to say: "Sanitary guides should tell us the meaning of these things."

"So far as we may presume to respond to this appeal," replies a physician in the same useful journal, "we must be allowed to point out, first, that there is a fallacy in the inference that because members of Congress, busy counsel, and, perhaps, actors and actresses, live on in spite of the adverse influences of surroundings which are held to be injurious to health, therefore the surroundings of their lives cannot be as injurious as they are supposed to be. One of the earliest exploits in the applied science of statistics as brought to bear upon sanitary questions was the drawing of an inference that, because the London night men, who slept as they might by day, and spent the hours of darkness in emptying cesspools, were able, as a class, to claim a very low rate of mortality, their mode of life and the work in which they were engaged could not be unhealthy. A good deal of excitement, we remember, was produced by this delivery some forty years ago. It was forgotten that another point of view was possible, and that, in truth, none but the inured could live under such conditions! So it is with members of Congress, busy counsel, and actors and actresses. The weakly and sensitive retire or die, or have the wit not to enter into a way of life which must obviously prove unsuitable. At the same time, we are quite prepared to meet our contemporary half way in his argument, though the inference with which he opens the debate is obviously faulty. We think a great deal of unpractical nonsense is talked and written on the conditions of health, and we are quite sensible of the fact that regimen and dieting may be carried too far. Practitioners and those who set themselves up as apostles of sanitary science are too prone to measure other people's corn by their own bushel. For example, a physician or surgeon may himself have been a too free liver—it is easier to preach than to practice—and he may have become a vegetarian just in the nick of time or with great advantage to his health; but this is certainly no reason why he should spend the remainder of his days in trying to persuade others that vegetarianism is good or necessary for them also. Again, a medical man may have a miserably weak digestive faculty, and need to avoid certain dishes which other folk can take, not only with impunity, but with benefit; but that is no reason why he should go about abusing and interdicting the things that disagree with him, while they agree perfectly well with the majority of mankind. By pushing dieting to the verge of starvation, we are simply pretending to cure, not curing; we impose on ourselves and on those who confide in our practice."

Sorrel's Millstone Cement.

The millstone cement discovered by Sorrel, the French chemist, some years ago, and since quite extensively used, is made in the following manner: The oxychloride of magnesium is the basis of an artificial burrstone, and is formed by adding a solution of chloride of magnesium, of the proper strength and in the proper proportions, to the oxide of magnesium, obtained by calcining magnesite. The magnesite is burnt by ordinary lime kilns at a dark cherry-red heat. The result is protoxide of magnesium, which is next ground to fine powder between horizontal millstones, making cement which is perfectly white. This "cement" is then mixed with ground or powdered burrstone in proper proportions.

When applied in repairing, filling the joints, cavities, and seams in French burr and other mill stones, it is wetted with chloride of magnesium, which converts the oxide of magnesium into the oxychloride. The now semi-plastic mixture is rammed or tamped into the holes required to be filled, where it hardens. The chemical result is due to the combination of the chloride with the oxide of magnesium, and this covering each particle of the ground burrstone with a thin film causes the mass to adhere together with such solidity that, when made into blocks or stones, it is capable of resisting a crushing weight of more than 20,000 pounds to the square inch.

ENGINEERING INVENTIONS.

A piston and valve rod has been patented by Mr. Joseph McGrail, of Savanna, Ill. This invention consists in the use of a sleeve on the rod and stem, which can be quickly fitted to an old rod or replaced when worn, thus saving the time and labor required for repair or replacement of worn valve stems and piston rods.

A car coupling has been patented by Mr. Alexander C. Lubbert, H., of Guaymas, Mexico. It has pivoted hooks carried by the drawheads, and arranged to engage by gravity with bars in the heads when running the cars together, the bars being drawn out or removed to uncouple the cars, together with additional bars, one in each drawhead back of the aforesaid bars, to retain the hooks in coupling position.

A condenser for steam pumps has been patented by Mr. Henry T. Blackwell, of What Cheer, Iowa. It is especially intended for use in mines, where the pumps are placed at deep levels, and is so arranged that the steam used for operating the pump is got rid of without using a long line of exhaust pipe, and the vacuum obtained in the steam cylinder aids the operation of the pump.

A stock car has been patented by Mr. Jonathan E. Pierce, of Deming's Bridge, Texas. This invention covers novel features of construction to guard the cattle from injury by the sudden starting or stopping of a car when filled with cattle, and provides means for guiding the cattle into the proper compartment of the car, and so the device may be worked by a train hand on top of the car.

A railway switch has been patented by Mr. Abraham Ayres, of New York city. According to this invention, an oscillating plate is operated by the weight of an animal drawing a car, so that, if driven on a right or left hand plate, a pivoted tongue will be moved toward or from the main rail, thus permitting the car to run on the main rails or be automatically switched to branch rails.

An automatic time signal for railways has been patented by Messrs. Francis H. Young and Frank I. Davis, of Port Morris, N. J. According to this invention, a magnet is rotated by a clock mechanism in connection with a pointer carrying spindle, and there are means for automatically making and breaking connection between the magnet and spindle, with other novel features, to constitute a device for use in railway stations to indicate to engineers the time at which preceding trains passed the signal.

A valve for steam radiators has been patented by Mr. Thomas S. Hewitt, of New York city. It is made with two plates having corresponding inlet and outlet openings, a valve seat, with spaces at its sides and ends, with corresponding ribs, and valve plug with recessed ends, operated by a stem and handle, the valve being so constructed that the inlet and outlet openings can be opened or closed by one movement, and a small quantity of steam can pass continuously from the inlet to the outlet pipe when the valve is closed.

An apparatus for laying submarine tunnels and tubes has been patented by Mr. Hayden H. Hall, of New Hamburg, N. Y. This invention consists in a movable caisson with a prow and means for attaching a draught chain or cable at one end, and at the opposite end a neck adapted to receive the end of a tunnel tube, the caisson having an air shaft or hatchway extending above the surface of the water, also a draught clevis, and there being besides numerous other novel details and combinations.

A bridge has been patented by Mr. Emmerich A. Werner, of New York city. This invention relates only to the chords of bow girders, and is independent of the system of bracing or its construction, introducing a plain tension or compression chord; the features of this girder are that measures of tendency to produce motion in any part of the girder are always positive, whatever the position of the load, and the absolute value of such measures is independent of the height of the crown joint above the abutments, for one and the same kind of loading.

MECHANICAL INVENTIONS.

A mechanical movement has been patented by Mr. James H. Carrington, of New York city. This invention relates to certain improvements in mechanical movements heretofore patented, and consists principally in the employment of an axial shaft for the transmission of fast or slow motion.

A centering tool has been patented by Mr. George W. Varnum, of Montgomery City, Mo. This invention covers a special construction and arrangement of parts to provide a simple, inexpensive, and easily worked tool for center punching or marking the square or untrued ends of rods, bars, and the like, preparatory to turning or drilling them.

A die for making steel jars, such as used in oil wells between the auger stems and sinker bars, has been patented by Mr. James J. Davin, of Bradford, Pa. The die is of special construction for striking the jars up by successive operations from solid steel bars, instead of their being made in parts and welded together, as heretofore, with the frequent result of burning and imperfect welds.

AGRICULTURAL INVENTIONS.

A corn cultivator has been patented by Mr. Andrew J. Sweeney, of Pana, Ill. This invention covers novel features of construction and arrangement to promote convenience in adjusting, guiding, and controlling cultivators, for use with corn and other crops, planted in hills or drills.

A cultivator has been patented by Messrs. Peter J. Hostetter, Oliver C. Bower, and Elijah M. Hopwood, of Bushton, Ill. It is for scraping the ground and cultivating plants grown in rows, and can be used in connection with the wheels and axle of ordinary two horse cultivators, to which it is easy of attachment; the scrapers clean the weeds and rubbish between the rows, and cutters shave the ground close up to the plants, while the plow can be regulated to any depth, or turned to heap up earth against the plants.

A combined harrow, clod crusher, and stalk cutter has been patented by Mr. David M. McElhaney, of Buena Vista, Ohio. It is constructed with wheels, an axle with cutters, a stationary frame with cutters, and a hinged frame with curved harrow teeth; the stationary and hinged frames are further connected by hooks, so the harrow teeth can be readily secured in working position, and raised from the ground in passing from place to place. The construction is such that when the machine is drawn forward the harrow teeth stir up and loosen the soil and break in pieces loose clods and soil, while stalks and weeds and unbroken sods are carried by revolving cutters up the teeth and over the axle till they strike the stationary cutters, where they will be cut in pieces.

MISCELLANEOUS INVENTIONS.

An elevator has been patented by Mr. Volney W. Mason, of Providence, R. I. This invention consists in mechanism for multiplying the power combined with hoisting chains and a balance weight for hand and power elevators.

A cock for water and gas fittings has been patented by Mr. Henry P. Drew, of New York city. This invention covers novel details in the construction and arrangement of parts, with the object of promoting security in the use of cocks in gas and water fittings.

A wash boiler has been patented by Mary R. Walpole, of Mayfield, Ky. This invention covers special features of construction for an improved steam clothes washer, to force a large quantity of steam and water through the clothes in a short time, whereby they may be washed without pounding or rubbing.

A trace holder has been patented by Mr. Joel Strong, of College Hill, Ohio. This invention covers improved means for holding the leathers of trace holders, in place of fastening them by screws or nails directly to the whiffletree, by which device the trace holder is made sound and reliable.

A steamer for cooking food has been patented by Mr. Charles A. Gibford, of Newton, Iowa. This invention covers a special construction of apparatus for cooking meats, vegetables, and other articles at the same time, but without risk of the odors of any of the articles affecting the others.

A hot air heating apparatus has been patented by Mr. John L. Hamilton, of St. Joseph, Mo. Its object is to utilize ordinary open grates for heating rooms above those in which the grates are placed, and to that end the invention consists in a special arrangement of flues and heating tubes.

A beehive has been patented by Mr. George L. Tinker, of New Philadelphia, Ohio. This invention covers various novel features in construction and the arrangement of parts of a hive to facilitate bee culture and also to increase the productive capacity of the swarms.

A scrubbing machine has been patented by Mr. John F. Cameron, of New York city. It is mounted on wheels, provides means for delivering water to point desired, means for reciprocating a brush or brushes to scrub a floor, means for taking surplus dirty water from the floor, and again applying clean water.

A pedal attachment for organs has been patented by Mr. John Swanson, of Mendota, Ill. This invention covers a special construction and arrangement of parts for an improved attachment to the pedals of cottage organs, for the purpose of reducing the power required to operate them, and to enable children to work the pedals.

A fire escape has been patented by Mr. Charles W. Joynt, of Makanda, Ill. It is of the folding ladder class, and consists in a ladder formed of a series of parallel side rods provided at their lower ends with right angled sockets for receiving the ladder rounds, and at their upper ends with eyes for receiving the round of the adjoining section of the ladder.

A tile kiln has been patented by Mr. Gregory Jennings, of West Cairo, Ohio. The construction of the flues and arches is such that a downward draught can be used and changed as necessary, in order to burn the tiles hard at the bottom and not too hard in the top part of the kiln, while the heat may be readily regulated.

The construction of buildings forms the subject of a patent issued to Mr. Elisha L. Randall, of Durand, Wis. The walls, ceilings, floors, roofs, and partitions are, according to this invention, built of solid plank, made impervious to the influence of the atmosphere by treatment with coal tar, the chimneys and foundations being also of the same material.

Scissors form the subject of a patent issued to Mr. Josephus T. Willis, of Cuba Station, Ala. The construction is such that they will not only be easy to manipulate, but they may be worn on the finger, ready for use at any time, a spring being combined with pivoted blades to throw them open, and there being a finger ring with rest on the handle end.

A bracelet has been patented by Mr. Shubael Cottle, of New York city. This invention relates to bracelets consisting of independent beads or boxes, and consists in connecting them permanently but loosely by means of short tubes with heads or flanged ends, which engage shoulders or inturned flanges of the boxes or beads.

An axle skein and box has been patented by Mr. William B. Meacham, of Boydton, Va. The under side of the axle arm is recessed, and here is fitted a metal section, in which there is arranged in bearings a revolving skein, the object of the whole being to reduce friction and facilitate the lubrication of vehicle axle bearings and to improve and strengthen the same.

A stop motion for knitting machines has been patented by Mr. Oliver H. Edwards, of New York city. This invention provides an improved device for automatically stopping a knitting machine in case the thread breaks, and consists of a peculiar construction and arrangement of parts, so that it may be applied to any circular knitting machine.

A sawing machine has been patented by Mr. James W. Poff, of Harrisburg, Ark. This invention consists of combinations of parts and their construction with the object of providing a simple and durable one man cross cut sawing machine, which may be worked by utilizing the weight of the operator, and with an easy, natural swing of the body, causing little fatigue.

An apparatus for feeding flour and other material has been patented by Mr. Anson D. Northrop, of Carbon, Iowa. This invention covers a peculiar construction and arrangement of parts for an apparatus intended more especially for use in feeding flour uniformly in large or small quantities, as in mills when the flour or stuff from the dust room is to be rebolted.

A water elevator has been patented by Mr. Eli McAllister, of Albia, Iowa. This invention relates to devices where two buckets counterbalance each other, and the construction is such as to impart to the rising bucket a differential motion which will raise the bottom thereof faster than the top after it has reached the trough of the well curb, so that the water will be poured from the bucket into the trough.

An insertible saw tooth has been patented by Mr. John C. Trullinger, of Astoria, Oregon. The removable tooth back or shank has a caschardened portion at the back of the inserted portion of the tooth, and there are other novel features, to prevent breakage and wear of the saw plate, and to obtain ample clearance in a more effectual way than has been possible heretofore.

A running gear for vehicles has been patented by Messrs. Sylvester Gesner, Jr., and James F. Stevens, of North Tarrytown, N. Y. This invention consists in the combination, with fifth wheel track plates having different diameters and secured to the under side of the wagon box, of a spring frame carrying the front axle and pivoted to the under side of the box by a king bolt, with other novel features.

A demonstrative electrical apparatus has been patented by Mr. James D. Culp, of San Felipe, Cal. This invention covers devices for accumulating and discharging electricity, showing electrical phenomena, producing discharges visible to the eye, and which can be made to pass in plain view into and through that class of substances called dielectrics, such as glass, shellac, and vulcanized rubber.

A bronzing machine has been patented by Mr. Jacob Schneider, of New York city. It has an endless belt, with brushes for rubbing bronze powder on printed matter on sheets on the belt, a brush for sweeping off the surplus bronze from the sheets, the latter being carried off through a flue, and a brush for cleaning the outer surface of the belt, with drawers for catching the waste powder.

A ditching machine has been patented by Messrs. Samuel M. Murray and John C. Stryker, of Tipton, Iowa. In combination with a suitable rectangular frame is a U-shaped metal scoop, together with a chute or slide, formed by a metal plate, for raising up earth out of a ditch, and a mould board to receive the earth and discharge it each way from the center on the banks of the ditch, with other novel features.

An ice hook has been patented by Mr. John G. Bodenstein, of Staatsburg, N. Y. The construction of an ice hook is simplified by this invention, according to which the pushing and pulling points are made of a single piece, formed from a bar with triangular cross section and pointed at its ends, the bar being twisted at the middle of its length and bent at the twisted part.

A die for cutting rattan has been patented by Messrs. Henry Heywood and David F. Pratt, of Gardner, Mass. The die has a series of bores at one end, and a single larger bore at the other end, with two or more longitudinal splitting ridges, feed rollers carrying the rattan stick against the front end of the die, and the ridges splitting it at one operation into as many pieces as there are bores and ridges.

A button and button fastening has been patented by Mr. Wm. J. Allason, of Billings, Montana Ter. The spring desk and headed shank are so formed as to serve as an ornamental front to the button, the head being made large, while the spring disk has a hemispherical bulge or swell which adds to the ornamental appearance of the button, and may be strongly secured and braced against strain.

A gate latch has been patented by Mr. Albert G. Rockfellow, of Ashland, Ore. This invention relates to a former patented invention of the same inventor, making improvements thereon, the present construction of catch differing from the former in providing a circular bead and upper and lower ends of the main notch, or groove with notches, for a vertically working latch to catch into.

A bird cage has been patented by Mr. John Putnam, of Philadelphia, Pa. The bottom plate is of glass, with the feed cups made integral therewith, and there are various other novel features, whereby the cleaning of the cage is facilitated and its appearance improved, the sand or gravel not adhering to the bottom, while it cannot be defaced by oxidation, as is the case with ordinary metal bottoms.

A fence and post lifter has been patented by Mr. Edmund B. Miller, of Dandridge, Tenn. This invention relates to means for raising posts and corners of fences which have sunk too low in the ground, and covers therefor special novel details of construction and combination of parts, making a machine that is simple, easy to manage, strongly constructed, and gives a powerful leverage.

A register for billiards has been patented by Mr. Robert Embrey, of North Lewisburg, Ohio. This invention covers a special combination and arrangement of parts, including a ratchet, pawl, and pointer, with other details, making a game counter intended to promote convenience and secure accuracy in registering the number of games of billiards, pool, and other games played.

A machine for mixing fertilizers has been patented by Mr. William B. Chisolm, of Charleston, S. C. A shaft is journaled longitudinally in a trough or box, with arms on the shaft, and blades or wings held adjustably on the arms, the blades or wings being inclined from the ends toward the middle of the box, with other novel features, to facilitate the mixing of phosphates, cement, ores, clay, etc.

A pot and kettle cover has been patented by Mr. Willis L. Brown, of Lake Geneva, Wis. This invention covers a special construction for a simple, cheap, and durable cover for cooking and other vessels, one which may be readily clamped upon or removed from the vessel, and will allow the draining of boiling water from the vessel without danger of scalding the hands or spilling the solid contents of the vessel.

A tea or coffee pot has been patented by Mr. Fred Wisner, of Ridgway, Pa. This invention relates to such pots fitted with a strainer in their body, and consists in a novel construction of the pot and attachments for supporting and removing a detachable strainer provided with handle, and serving to pour freely and keep back all sediment, or to strain beneath the spout the beverage as it is poured from the spout.

A steam generator has been patented by Mr. Andrew Welte, of Atchison, Kan. This invention relates to generators used on farms for cooking feed for stock, and has for its object to produce a great amount of steam relatively to the amount of fuel consumed, and economy in the cost of the generator, and to this end covers a special construction and combination of parts.

An improvement in calipers has been patented by Mr. Stewart A. Jellett, of Philadelphia, Pa. The scale is marked upon the face of the one leg where or nearly where the same is usually made widest, and, not forming an objectionable protrusion, is prevented from getting out of order, while the other leg has indicating pointers so arranged that when the calipers are closed to carry in the pocket the pointers are protected from being broken off or tearing the pocket.

A transcycle has been patented by Mr. John A. Enos, of Peabody, Mass. It consists of a single wheel mounted upon an elevated truck, with a seat and treadle or driving mechanism beneath the point of support and properly connected with the wheel, with gearing for transmitting the power from below to the wheel above for propelling the latter on the track, so the center of gravity will always be approximately beneath the point of support of the wheel on the track.

A collar button has been patented by Mr. Shubael Cottle, of New York city. This invention covers an improvement on a former patented invention of the same inventor, in which the back of the button, formed in one piece with a hollow post, may be made either with or without a small central aperture communicating with the post, making a button whose back is double and yet solid, or in one piece with the hollow post.

A baling press has been patented by Messrs. William F. Smith and William W. Adams, of Ozark, Ark. This invention covers a contrivance of feed and compressing mechanism with the press for compactly delivering the lint from the gin into the press; also an improved automatic tramping mechanism for beating down the lint compactly in the case prior to the action of the follower, with other novel details of construction.

A hame tug and trace fastening has been patented by Mr. William H. Tyler, of David City, Neb. The hame tug has an outer plate with oppositely arranged studs to take the draught of the trace, and with trace and back strap loops, longitudinal rib, and face plate along the rib facing the studs, with other novel features, to make a simple and durable tug and fastening, easily adjustable to alter the length of the trace.

A machine for shaping buttons has been patented by Mr. Emil Weyerbusch, of Elberfeld, Germany. This invention covers a novel arrangement and combination of parts constituting a machine for turning and boring buttons of ivory and bone and similar materials to finish the button out of the rough without taking from the machine, so the cutters will not wear rapidly, and will work exactly and without frequent stoppages, while the machine is so constructed as not to require skilled labor in its management.

A cotton gin has been patented by Mr. Eli C. Horne, of Jasper, Fla. It has a knife adjustably secured to its holding plate by screws, with its edge near the ginning cylinder, so as to separate the reeds from the fibers as the latter are drawn between the cylinder and knife, and at the rear of the knife are a vibrating bar and plate to straighten the fibers and push back the seeds, with other novel features, to facilitate the ginning of cotton and prevent the fibers from being broken.

A becket clamp for steering wheels has been patented by Mr. Aladin Dole, of Penn's Grove, N. J. It is for holding the steering wheel of a vessel to any desired adjustment, and for stopping the sudden whirling of the wheel when it gets away from the steersman, and consists in combining with the wheel shaft an encompassing clamp, made in two parts hinged together, one of which may be adjusted by a crank screw, so the clamp may be made first to act as a brake, and then as a firm lock to prevent the rotation of the shaft.

A strap buckler and wrench combined has been patented by Mr. Thomas P. Evans, of Philadelphia, Pa. This invention has for its object the buckling or drawing together the ends of straps on the canvas of reaping and binding machines, also trunk and other straps, and in the device a lever has combined with it in a peculiar manner pivoted hooks that take into the buckle and engage with the strap, so that when the lever is raised or moved away from the straps the drawing power of the device is increased when most needed.

A tellurian, for showing the different relative positions of the sun, earth, and moon, in the different seasons, has been patented by Messrs. William G. Short and Henry L. Short, of Larue, Ohio. The base has an upright shaft, on the upper end of which is a ball representing the sun, and on the shaft an arm is held to turn, on the free end of which a vertical shaft is journaled, with other special features of construction to facilitate showing the position of the earth for each day of the year, and illustrate the movement of the moon and tides, etc.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Mittens.—¾'s of all made in the country to-day on our machines. Lamb Knitting Machine Co., Chicopee Falls, Mass.

Steamboats supplied with Pumps for every service by Valley Machine Works, Easthampton, Mass.

Send for Special List of Second Hand Machinery. Pond Machine Tool Co., Worcester, Mass.

The patent right of Brill's patent Printer's Chase, illustrated in this number, is for sale. Address A. C. Pieyte, 1719 Walnut St., Milwaukee, Wis.

Wanted—First class Wood Pattern Maker, experienced in making patterns for brass castings. United Brass Co., Lorain, Ohio.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

The leading Non-conducting Covering for Boilers, Pipes, etc., is Wm. Berkefeld's Fossil Meal Composition; ½ inch thickness radiates less heat than any other covering does with two inches. Sold in dry state by the pound. Fossil Meal Co., 48 Cedar St., N. Y.

Machinists.—Spring Calipers and Dividers, with patent washers, made by J. Stevens & Co., Box 28, Chicopee Falls, Mass.

Try our Corundum and Emery Wheels for rapid cutting. Vitrified Wheel Co., 38 Elm St., Westfield, Mass.

The Providence Steam Engine Co., of Providence, R. I., are the sole builders of "The Improved Greene Engine."

Every variety of Rubber Belting, Hose, Packing, Gaskets, Springs, Tubing, Rubber Covered Rollers, Deckle Straps, Printers' Blankets, manufactured by Boston Belting Co., 226 Devonshire St., Boston, and 70 Reade St., New York.

Stephens' Pat. Bench Vises and Planer Chucks. See adv., p. 78.

For sale.—Large Air Compressor, 24" x 24" air cylinder; steam cylinder, 18" x 24"; coupled to one shaft, with cranks at right angles; also has 10' band, wheel 16" face. Good as new. Will be sold very low. Address Henry I. Snell, 135 N. 3d St., Philadelphia, Pa.

Experimental Machinery Perfected, Machinery Patterns, Light Forgings, etc. Tolhurst Machine Works, Troy, N. Y.

Bermuda Scientific Collections. Naturalist, Box 3359, N. Y.

Wanted.—A first-class man to superintend a Sash, Blind, and Door Factory; outfitted with all late and improved machinery; working about one hundred hands. Must be sober, a good manager, and estimator on job work. To the right man a good salary and permanent employment will be given. Or I will sell a half interest in the above well established business. Address, with full particulars as to age, habits, qualifications, and recommendation, R. F. Learned, Natchez, Miss.

Whistles, Injectors, Damper Regulators; guaranteed. Special C. O. D. prices. A. G. Brooks, 261 N. 3d St., Phila.

Brush Electric Arc Lights and Storage Batteries. Twenty thousand Arc Lights already sold. Our largest machine gives 65 Arc Lights with 45 horse power. Our Storage Battery is the only practical one in the market. Brush Electric Co., Cleveland, O.

The Cyclone Steam Flue Cleaner on 30 days' trial to reliable parties. Crescent Mfg. Co. Cleveland, O.

For Steam and Power Pumping Machinery of Single and Duplex Pattern, embracing boiler, feed, fire and low pressure pumps, independent condensing outfits, vacuum, hydraulic, artesian, and deep well pumps, air compressors, address Geo. F. Blake Mfg. Co., 44 Washington St., Boston; 91 Liberty St., N. Y. Send for catalogue.

Stationary, Marine, Portable, and Locomotive Boilers a specialty. Lake Erie Boiler Works, Buffalo, N. Y.

Wanted.—Patented articles or machinery to manufacture and introduce. Lexington Mfg. Co., Lexington, Ky.

"How to Keep Boilers Clean." Book sent *free* by James F. Hotchkiss, 86 John St., New York.

Mills, Engines, and Boilers for all purposes and of every description. Send for circulars. Newell Universal Mill Co., 10 Barclay Street, N. Y.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

For Power & Economy, Alcott's Turbine, Mt. Holly, N.J.

Steam Boilers, Rotary Bleachers, Wrought Iron Turn Tables. Plate Iron Work. Tippett & Wood, Easton, Pa.

Send for Monthly Machinery List
to the George Place Machinery Company,
121 Chambers and 103 Reade Streets, New York.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. Complete outfit for plating, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty, St., New York.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 78.

Curtis Pressure Regulator and Steam Trap. See p. 14.

Woodwork'g Mach'y, Rollstone Mach. Co. Adv., p. 14.

Drop Forgings, Billings & Spencer Co., Hartford, Conn.

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co., 419 East 8th street, New York.

Rubber Skate Wheels. See advertisement, page 13.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Emerson's 1885 Book of Saws free. Reduced prices for 1885. 50,000 Sawyers and Lumbermen. Address Emerson, Smith & Co., Limited, Beaver Falls, Pa.

Hoisting Engines, Friction Clutch Pulleys, Cut-off Couplings. D. Frisbie & Co., Philadelphia, Pa.

Barrel, Keg, Hogshead, Stave Mach'y. See adv. p. 78.

Swift's Patent Coffee Roasters and Mills, 30 sizes. Lane Bros., makers, Box 276, Poughkeepsie, N. Y.

Munson's Improved Portable Mills, Utica, N. Y.

Machine for grooving chilled rolls for flour mills. Pratt & Whitney Co., Hartford, Conn.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, send for catalogue to Rowley & Hermance, Williamsport, Pa.

The Porter-Allen High Speed Steam Engine. Southwark Foundry & Mach. Co., 430 Washington Ave., Phil. Pa.

Seaming and Looping Machines, Patent Burr Wheels, Brushing Machines. Tubbs & Humphreys, Drawer 1657, Cohoes, N. Y.

Young Men! Read This!

The VOLTAIC BELT CO., of Marshall, Mich., offer to send their celebrated ELECTRO-VOLTAIC BELT and other ELECTRIC APPLIANCES on trial for thirty days, to men (young or old) afflicted with nervous debility, loss of vitality and manhood, and all kindred troubles. Also for rheumatism, neuralgia, paralysis, and many other diseases. Complete restoration to health, vigor, and manhood guaranteed. No risk is incurred, as thirty days' trial is allowed. Write them at once for illustrated pamphlet free.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

NEW BOOKS AND PUBLICATIONS

LOCOMOTIVE ENGINE RUNNING AND MANAGEMENT. A treatise on locomotive engines. By Angus Sinclair. John Wiley & Sons, New York.

This book will be found especially valuable to engineers and mechanics who have worked their way into responsible positions, or who are doing so, through their personal energy and perseverance rather than by the aid of a regular course of study and the advantages of favorable connections. It is plainly written throughout, so that not only firemen and machinists, but those in no way connected with such business, can readily understand its statements and reasoning, yet it gives a vast amount of detail, derived from long experience of the writer as a practical engineer, and one having had charge of the motive power and repairs of a prominent branch of railway. It does not pretend to be anything more than an elementary work in mechanical engineering, but will form a valuable addition to a class of practical instruction books now finding great favor with the public.

ORIGINAL RESEARCHES IN MINERALOGY AND CHEMISTRY. By J. Lawrence Smith. Edited by J. B. Marvin. Printed at Louisville, Ky., for presentation only.

This is a memorial volume, prepared at the request of the widow of the late Professor Smith, and containing a sketch of his life written by Dr. Marvin, at the request of the American Academy of Arts and Sciences. From 1842 to 1873 Professor Smith was prominent as an original investigator in the departments of chemistry and mineralogy, having been a lecturer in the Charleston Medical College and Professor of Chemistry in the University of Virginia, and afterward succeeding Professor Silliman in that department in the University of Louisville. He was one of the earliest to point out the mineral resources of the South, and was for a number of years a mining engineer in Turkey, where he went on solicitation of the Sultan through our Secretary of State. Professor Smith died February 12, 1883, in his 65th year.

SEASONAL CLIMATIC MAPS OF THE UNITED STATES. By Charles Denison. Rand, McNally & Co., Chicago.

These maps embrace five different presentations of the climatology of the United States on a substantially mounted chart 40 by 60 inches. One side of the chart has four different views—one each for spring, summer, autumn, winter—and each showing, for those seasons, humidity, isothermal lines, direction of prevalent and wet and dry winds, altitudes, etc., while the other side shows the averages in the conditions in one large map for the whole country together. The various degrees between extreme moisture and extreme dryness are indicated by eight shadings, from deep blue to deep red. The data for these exhibits are compiled from reports of the United States Signal Office, but the way in which the information is here presented enables one to cover a very large field understandingly at a glance.

THE MAGAZINE OF AMERICAN HISTORY, edited by Mrs. Martha J. Lamb, has now entered upon its thirteenth volume. Each number of this publication always presents an admirable collection of papers, and maintains the high character of the gifted editor, who, in her history of New York city, displayed the highest qualities of an author. The magazine is as instructive as it is entertaining, its frontispiece in the February number being a portrait of the eminent Mohawk chief, George H. M. Johnson, or Onwanonsyshon, accompanied by a spirited sketch. Among other interesting articles, some of which are illustrated, are "The Early New York Post Office." "Benedict Arnold's March to Canada," "The Character of Andrew Jackson," and "Andre's Landing Place at Haverstraw." The magazine is handsomely printed and illustrated, and is sold for 35 cents a copy, $5 a year. Office of publication, 30 Lafayette Place, New York city.

Received.

ANNUAL REPORT OF THE UNITED STATES SECRETARY OF THE TREASURY for the fiscal year ending June 30, 1884. Washington: Government Printing Office.

THE FIREMAN'S GUIDE. A handbook on the care of boilers. By Karl P. Dahlstrom. E. & F. N. Spon, New York and London.

LEE'S MAP OF THE INDUSTRIES OF PITTSBURG AND ALLEGHENY CITY. No. 2. Alex. G. Lee, Pittsburg, Pa.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter,** should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) G. F.—For ascertaining the volume of steam used in lifting water by an injector: From measurements of the suction tank and receiving tank ascertain the increase of bulk of receiving tank after a stated run of the injector in cubic feet of water, which multiplied by $62\frac{5}{10}$ pounds, the weight of one cubic foot of water, will give the amount of water derived from the steam in boiler. Multiply the weight of water thus ascertained by the tabular number of cubic feet of steam per pound of water for the pressure that you carry in the boiler, for the volume of steam used. You will find this table in most works on steam for every pound of variation in pressure. Thus for:

15 lb.	pressure	$13\frac{1}{4}$	cubic feet	steam = 1 lb.	water.
20 lb.	"	$11\frac{1}{8}$	"	" = 1 lb.	"
25 lb.	"	$10\frac{11}{100}$	"	" = 1 lb.	"
30 lb.	"	$9\frac{11}{100}$	"	" = 1 lb.	"
40 lb.	"	$7\frac{11}{100}$	"	" = 1 lb.	"
50 lb.	"	$6\frac{11}{100}$	"	" = 1 lb.	"
60 lb.	"	$5\frac{11}{100}$	"	" = 1 lb.	"
70 lb.	"	$5\frac{1}{100}$	"	" = 1 lb.	"

and so on. The temperature is not essential in any ordinary computation, as the volume of water discharged modifies the temperature and becomes the absolute basis of calculation.

(2) B. asks: What is considered the general analysis of ground beef bones? A. The following analysis by Heintz is given in Ure. It is of the femur of an ox:

Animal matter	30·58
Phosphate of lime	57·67
Fluoride of calcium	2·69
Carbonate of lime	6·99
Phosphate of magnesia	2·07

(3) J. M. C.—Roofing tile when properly laid have a life of several hundred years more or less, according with climate. Slate a little less. Slate is the cheapest. Roofing tile is made in New Jersey.

(4) G. P.—Make soft solder from tea lead by melting with equal part of block tin.

(5) H. A. P.—We presume annatoine is one of the numerous synonyms for annatto, the yellow coloring matter.

(6) J. H. D. asks for a cement or paste that will fasten cotton cloth on sheet iron, that will withstand the action of weather and rain. A. Use a cement made by melting equal parts of asphalt and gutta percha, and applying the mass hot under a press. See also waterproof cement, SCIENTIFIC AMERICAN SUPPLEMENT, No. 158.

(7) F. W. S. asks: What can be added to ashes from bituminous coal, that will form good and inexpensive walks for yards and grounds used only for pedestrians? How made and how put down? A. Good hydraulic cement, equal parts by measure. Mix dry, then wet the whole quickly as in making mortar, and spread smoothly with shovel. Two inches thick is sufficient for ordinary paths.

(8) W. J. S. asks: What will remove those black flesh worms from the face? A. Cover the parts affected with a pomade consisting of kaolin 4 parts, glycerine 3 parts, acetic acid 2 parts, with the addition of a small quantity of some ethereal oil.

(9) B. F. S.—For removing ink see the answer given to queries Nos. 39 and 41, in our issue of November 22, 1884. Manhattan Island is 13¼ miles long, and 2¼ miles in width at certain points.

(10) J. B. asks how many steam boilers there are in the United States. A. According to the census of 1880, there were 72,304 boilers in use in manufacturing industries, and 5,403 steam vessels. Poor also gives the number of locomotives at 25,000.

(11) W. C. B.—Flexible tubes, such as rubber hose and the like, are largely used for transmitting the elements of power, such as steam, air, and water; but the motion due to such power has to be developed at the exit end of such tubes by appropriate appliances. Your half horse power from a blast is feasible, but we cannot construct your appliance.

(12) E. A. P. asks for receipt for making green ink that will copy. A. The receipt for a green ink is given on page 2498 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 157. The addition of a small quantity of glycerine will cause it to copy. An aniline green soluble in water and mixed with glycerine with a little alcohol should likewise give satisfactory results.

(13) E. W. A.—Locomotive wheels and car wheels vary much in size. If you will multiply the diameter of any wheel by 3·1416, and divide the number of feet in 40 miles by this sum, you will obtain the whole number of revolutions in 1 hour; divide this quotient by 60 for the revolutions per minute.

(14) J. E. L. asks: How many pounds to the square inch is called high, and how many pounds is called low, pressure of steam, when used in buildings for heating purposes and return to boiler? A. From 10 pounds upward is generally called high pressure; from 0 pound to 10 pounds, low pressure. Much of our low pressure heating is efficient with from 1 to 3 pounds.

(15) E. R. asks (1) what to add to China ink to make it flow easily and without interruptions on tracing cloth. A. It has been found that if genuine Indian ink be rubbed with good black ink until it will flow easily from a pen, excellent results will ensue. 2. Whether there is any possibility of restoring the transparency of tracing cloth, when it has been damaged by water drops, so that in copies made by the blue process no stains will be noticed, and what should be done to the purpose? A. Tracing cloth is coated with a varnish which varies with different makers, so that the spots can be restored by coating them with the proper varnish, whatever it may be. Frequently equal parts of Canada balsam and turpentine are used.

(16) P. B.—Encke's comet is not visible as yet to the naked eye. For other particulars see illustrated article in SCIENTIFIC AMERICAN, January 24, 1885. A planet is said to be stationary when the orbital motion of the earth and the planet so coincide that the planet appears for a short time not to move in its position among the stars. The nodes are the points where the orbits of the planets intercept the ecliptic, descending south, ascending north.

(17) P. H. McN. asks: Is there any loss of motor power in the use of the reciprocating steam engine in transferring that power from the reciprocating to the rotary motion, through the crank and its connections to the main shaft? If so, what per cent? I find that engineers differ on this subject. A. Engineers do not differ so much as to the fact as they do in the methods and necessity of overcoming the apparent loss by special contrivances. Although the actual loss may be about 37 per cent, the smoothness of motion of the crank and its ease of reversion are well worthy of its loss of power over the jerky rectilinear motion. Modern engineering practice has long since settled the theoretical dispute in favor of the crank.

(18) F. J. C. asks for a receipt for frosting silver. A. Dip the article in a solution of nitric acid and water, half and half, for a few minutes, then wash well in clean water, and dry in hot sawdust. When thoroughly dry, brush the sawdust away with a soft brush, and burnish the parts roquired to be bright.

(19) F. H. W. asks: 1. Is there anything better than fluoric acid with which to etch on glass? A. No. The sand blast is used to a certain extent. 2. How is the matter applied, if there is any other way than by the use of wax? A. Two slightly differing processes by means of fluoric acid are described, the first on page 2690 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 169, and the second on page 4994 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 313. 3. What is the fluid sometimes called diamond ink, used to etch glass? A. Diamond ink is a trade name given to some particular variety of etching ink. See page 232 of SCIENTIFIC AMERICAN, for October 11, 1884, for method of manufacturing the same.

(20) Merlin asks for a formula for making violet or purple (the best) ink for using with the hektograph. A. The ink you desire is prepared by dissolving one part aniline blue violet in a mixture of seven parts water and one of alcohol.

(21) W. T. G. asks the most effective stain for ash. I desire to stain a dark color, say imitation of ebony. If this wood can be effectively stained ebony, will you be good enough to give me a good recipe for such a stain, and say whether it should be put on hot or cold. A. We recommend the following: Dissolve 4 ounces shellac with 2 ounces borax in ¼ gallon of water. Boil until a perfect solution is obtained, then add ½ ounce glycerine, after which add, in sufficient water, soluble aniline black, and the mixture is ready for use. See also process given under "Dyeing Wood Black," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 207.

(22) J. E. J. desires a formula for mixing water colors, so as to form cakes that won't crack in drying. A. Water colors mixed with gelatine, and afterward fixed by washing with a solution of alum or with curd of milk, washed and pressed, then dried on fine net, and, when required for use, mixed with water and the coloring matter.

(23) Q. C. A. asks: 1. Is there any known chemical or substance that will remove the stain or scar produced by the burn of sulphuric acid (on the flesh)? It was done about two months ago, and left a dark red stain and scar. A. We know of nothing that will remove the scar, except time. The skin is burnt, and it will take time for a new cuticle to grow. 2. Please give me a receipt for gold ink. I can make it, but have trouble in keeping the bronze held in solution; it settles. A. For gold ink, take 24 leaves gold; ½ ounce bronze gold; 30 grains best honey; 4 drachms gum arabic; 30 drops spirits of wine; 4 ounces rain water. Rub the gold with the honey and gum, and having mixed it with the water, add the spirit.

(24) V. C. H.—To definitely express an opinion concerning the proper means of preventing boiler scale is almost impossible without an exact knowledge of the composition of the water used, etc. On page 4553 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 286, you will find an article on the "Complete Prevention of Boiler Incrustations." In SUPPLEMENT, No. 137, tannates of soda are recommended. In general all woods rich in tannin are used. Filtering through iron may be advantageous for drinking purposes, but we do not see that it will affect the lime salts contained in the water.

(25) A. P. C. asks how to remove painted letters from a brick building. A. To properly answer your question, the conditions must be more thoroughly explained. To remove paint from stone, use three pounds of common washing soda dissolved in a gallon of boiling water. This, if applied hot, will so soften the paint that in a short time, it can be readily removed with a stiff scrubbing brush.

(26) J. De L. T. writes: Given two vessels for milk setting, of same diameter, A being four inches deep, B being forty inches deep, is it a fact that cream will rise quicker in B than in A? Or, in other words, is it a fact that cream in B will not take ten times (or about) more time to rise than in A? A. The cream in B will rise quicker on account of its containing a greater amount of milk, but not quicker in proportion to whole amount. It is more a matter of practical experiment than any demonstration of a scientific principle.

(27) A Reader asks (1) if there is any solvent for vulcanized rubber. A. Chloroform, carbon bisulphide, and naphtha are among the solvents for rubber. 2. How are old rubbers made over into new ones? A. Old rubbers are chopped fine, cut with naphtha, and then worked over with a certain proportion of new or original rubber. 3. Is solid rubber type vulcanized in metal or plaster moulds? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 251, for information concerning rubber type.

(28) B. & Co. write: We wish to place tin foil on japan tin with a mucilage or cement so that it will dry and cleave to the japan so firmly that water or weather will not remove it. A. Try the following: Make a dilute solution of white gelatine or isinglass; the proper proportions are one to twenty; add a little potassium bichromate, and apply it by means of a pencil or sponge. It does not adhere at once, but will do so in a short while.

(29) W. S. N.—The imitation grapes are made of thin blown glass subsequently coated with a varnish of the coloring material. They can only be made by an experienced glass blower.

(30) W. G. writes: In describing on page 20 how to make balloons and soap bubbles of collodion, you do not say how such a solution should be made; will you state how a collodion solution must be made, to answer the above named purposes? A. Collodion is prepared by mixing 21 fluid ounces of stronger ether with 6 fluid ounces stronger alcohol in a suitable bottle, add the quantity of gun cotton, and shake until dissolved. It can be purchased directly from any dealers in photographic supplies.

(31) P. R. writes: What is the greatest steam pressure a boiler 4 feet long, 15 inches diameter, 22 one-inch flues will stand? The shell one-eighth inch steel, heads three-sixteenths inch steel, with a strength of 65,000 pounds. What is the horse power of such a boiler, a plain cylinder, with fire under it, to go to one end and return through the flues? What is the power of an oscillating engine 2⅜ inches by 4½ inches stroke, running at 300 revolutions a minute at the pressure the boiler will safely stand? A. Your boiler should bear a working pressure of 50 pounds per square inch, and rates a little less than 2 horse power. Your engines rate 1¼ horse power at speed of 300 with 30 pounds mean pressure.

(32) F. H. R. writes: Photographers usually save the clippings of the sensitive albumen paper, filter papers, etc., which are subsequently reduced to ashes and sent to the assayer to be reduced to the metallic state, to be afterward converted into nitrate of silver again. Can you suggest any plan by which the ashes can be converted into nitrate of silver without first being brought to the metallic state? A. It is best to prepare the nitrate from metallic silver. You can, however, reduce the silver yourself by fusing it with a little borax in a sand crucible in an ordinary coal fire. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 307.

(33) W. D. F. and H. B. S. ask: Is it a fact that the upper part of a wheel of a vehicle driven over the ground revolves faster than the lower part? If so, please explain the cause? A. The top does not revolve around the axle any faster than the bottom. The top moves along the road twice as fast as the axle. The bottom stands still in relation to the road, but moves backward in relation to the vehicle. The misapplication of a word gives rise to much disputation. A wheel revolves on its own center, and every portion of its periphery has the same relation to its center in regard to speed.

(34) E. K. G. asks: What is the process of preparing and sensitizing paper for solar camera printing? A. The following method of preparing paper for solar printing is given by Libois: Take thin Saxe paper, and float it for a minute on the following salting solution:

Chloride of ammonia	4 drms.
Citric acid	4 "
Rain water	25 oz.

The citric acid is first dissolved in two and a half ounces of water and completely neutralized by bicarbonate of soda, five drachms of which are required to neutralize three drachms of the acid. The solution of citrate of soda thus formed is added to the solution of chloride of ammonium. The solution must have a slight acid reaction, which is attained by the addition of a few drops of a solution of citric acid. A small quantity of boiled arrowroot is also mixed with this bath, which is said to improve the final tones. The paper is next hung up to dry, after which it is sensitized by floating on the following bath for half a minute:

Nitrate of silver	1 oz.
Water	18 "

The bath is acidified with a few drops of a solution of citric acid. The first few drops produce a slight precipitate of citrate of silver, which is at once dissolved by the succeeding drops. When this is effected, the bath is sufficiently acid. It is important that the paper be thoroughly dried before it is pinned on the focusing screen in the camera. For exposure and directions regarding development, see Notes and Queries, No. 6, page 90, of SCIENTIFIC AMERICAN, vol. lii.

(35) J. C. W. asks whether brass will do for an engine cylinder 4x5. How thick should the casting be? What sized ports and bridges should be used? What kind of material for packing rings; if brass will do? A. Ordinary yellow brass is not fit for a cylinder. If you make a composition of 1 pound copper to 3 ounces tin, you have a good metal. Make the cylinder ½ inch thick except where needed thicker around steam ports. Ports ⅛x2¼. Exhaust ⅝x2¼. Bridge ⅝ wide. Make the packing rings of above composition. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 34, for proportions of engines.

(36) E. B. asks for a receipt for a gold paint such as is used on steam heating racks put on with a brush. A. Steam heating racks are generally coated with bronze powder, but you can use a golden varnish such as the following: Pulverize 1 drachm of saffron and ½ drachm of dragon's blood, and put them into 1 pint spirits of wine. Add two ounces of gum shellac and 2 drachms of Socotrine aloes. Dissolve the whole by gentle heat. Yellow painted work varnished with this mixture will appear almost equal to gold.

(37) F. L. asks: 1. What is the receipt for the fluid in a barometer, which seems to be made of a test tube filled with water and gum camphor? A. A simple weather glass is thus made: Take a glass tube about ten inches in length and one inch in diameter, and fill it nearly to the top with the following liquid: Two parts camphor, one part nitrate of potash, and one part sal ammoniac, dissolved in strong spirit of wine, then add water until the camphor is partially precipitated. The extremity of the tube can be left open or hermetically closed, but is fixed in a vertical position against the wall or a board. This kind of a weather glass is very uncertain in its operation, but it is claimed that if the weather is to be fine the substances will remain entirely at the bottom of the tube, and the liquid will be clear, but that before rain crystals will form. 2. Is the wire on an electromagnet wound in the same direction on both coils? A. Yes.

(38) J. P. asks the formula to find the diameter of the following: In the curve of a railway I stretched a line 80 feet in length, and the distance from the line to the curve was 9 inches. Required the diameter of the circle. A. When the chord and versed sine are given, to compute the diameter, divide the square of the chord of half the arc by the versed sine. For the chord of half the arc, take the square root of the sum of the squares of half the chord of the arc and the versed sine. Half chord = 40 feet, or 480 inches; $480^2 + 9^2 = 230{,}481$, which is the square of the chord of half the arc. Then

$$\frac{230{,}481}{9 \text{ versed sine}} = \frac{25{,}600 \text{ inches}}{12'' \text{ to } 1 \text{ foot}} = 2{,}134' \; 1'' = \text{diameter of the circle.}$$

Another and convenient rule: Divide the square of ¼ the chord by ⅙ the versed sine, and add to the quotient ⅓ the versed sine; the sum equals the radius. As in your question:

$$\frac{20^2}{0{\cdot}375} = 1{,}066{\cdot}666 + {\cdot}375 = 1{,}067{\cdot}0416 = \text{radius.}$$

$$\frac{}{2} \qquad 2{,}134{\cdot}0832 = \text{diameter.}$$

(39) H. C. W. writes: I have a telescope with a 2½ inch object glass, but I mistrust the effective aperture is much diminished by the internal structure of the instrument. Is there any way I can test whether it gives as large a field as it ought? A. Look inside of the tube with the eye piece taken out, and find if the diaphragm interferes with the sight of the edge of the object glass. If the whole surface of the object glass cannot be seen, the diaphragms have been put in to cover defects in the definition of the glass.

(40) S. T. C. asks: How are small iron castings made a bright copper color? A. Make a solution in water of the ordinary blue vitriol of commerce, and use it as a bath. Its strength may differ according to the time the articles are immersed.

(41) F. P. W. asks: How is the dead white surface produced on the dials of aneroid barometers? A cyanide solution would dissolve the black letters and figures, which are made of shellac, and the surface is not like that produced by "cold silvering." A. The shellac letters are not made until after the matte surfacing is done, and they are not affected by the cyanide solution. The dead surface is produced on metal by the electrical battery bath or by a "silver powder" of precipitated silver, cyanide of potassium, whiting, and ammonia, rubbed on by a chamois skin pad. If the material is paper or wood, the surface is made by painting with silicate of soda and dry zinc paint. These articles can be procured mixed in proper proportions at a druggist's or paint shop.

(42) C. N. V.—The following is used for the transferring of engravings on wood. Take a saturated alcoholic solution of potash, pour the solution on the engraving, and immediately remove all the superfluous liquid by means of blotting paper. Lay the engraving while damp upon the wood or other material to which it is to be transferred, and place it in a press (a copper plate press is the best). The transfer will be obtained immediately. The engraving must be immersed in clear cold water after removal from the potash bath and before putting it into the press. Good wood engraving commands excellent prices. In regard to selecting a profession, we cannot advise you. Competent men will succeed in any profession.

(43) J. C. T. asks: What is the greatest pressure ever used in the largest ordnance or produced with the largest charges used by artillerists in the world? A. About 40,000 pounds to the square inch.

(44) R. B.—The finish on copper goods is made with a burnisher to harden the surface, when a rouge polish gives it a luster. The copper is toned previous to burnishing, by boiling in a sulphuric acid and water pickle, about 1 part acid to 6 of water.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted,

February 3, 1885,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acid, production of sulphurous, I. S. McDougall.. 311,595
Air pressure apparatus and refrigerator, combined, C. Heintz *et al*.... 311,831
Animal trap, B. T. Otos.... 311,778
Annunciator for telephone systems, Childs & Shaw.... 311,672
Apron guide, endless, J. W. Millet.... 311,844
Awning, window, M. Moneyment.... 311,510
Axle box, car, S. A. Bemis.... 311,717
Axle cutter and threader, E. F. Dalton.... 311,647
Axle lubricator, car, T. R. Gordon.... 311,743
Axle skein and box, W. B. Meacham.... 311,774
Baling press, A. S. Robinson.... 311,680
Ballot box, Munroe & Sullivan.... 311,512
Battery. See Electric battery.
Bedstead, wardrobe, L. W. Welch.... 311,623
Beefsteak tenderer, A. Rein.... 311,527
Bicycle, F. Swain.... 311,687
Bicycle wheel, G. E. Blackham.... 311,808
Bird cage, J. Putnam.... 311,848
Block. See Sawmill head block.
Boiler. See Wash boiler.
Boiler cleaning apparatus, W. Ord.... 311,672
Book holder, L. W. Noyes.... 311,514, 311,515
Boring bar, L. R. Faught.... 311,652
Bottle, mucilage, W. H. Redington.... 311,849
Bottle stopple, L. S. Hoyt.... 311,834
Box. See Ballot box. Pile box.
Bracelet, S. Cottle.... 311,722
Bracket. See Roofing bracket.
Brick and tile kilns, drying apparatus for, C. L. Ames.... 311,557
Bridge, E. A. Werner.... 311,624
Bridle blinder or winker, W. W. Beach.... 311,562
Bridle winker, W. W. Beach.... 311,561
Bronzing machine, J. Schneider.... 311,612
Buggy top support, A. Witzel.... 311,709
Buildings, construction of, E. L. Randall.... 311,677
Burner. See Vapor burner.
Button, P. Hirshfield.... 311,753
Button, J. E. Totten.... 311,794
Button and button fastening, W. J. Allason.... 311,460
Button hook, J. A. Smith.... 311,539
Button or stud, C. H. Cooke.... 311,474
Button shaping machine, E. Weyerbusch.... 311,700
Cable and car, traction, J. H. Smith.... 311,537
Calcining and chloridizing furnace, W. H. H. Bowers.... 311,804
Calipers, C. H. Alapaw.... 311,809
Can. See Oil can.
Canister, C. M. Symonds.... 311,690
Capsule machine, Hubel & Reinhold.... 311,835
Capsule machine, H. H. Taylor.... 311,900
Capsule mould pins, machine for greasing, Hubel & Reinhold.... 311,659
Car bearing, F. G. Susemihl.... 311,618
Car body truss, J. Stephenson.... 311,541
Car coupling, J. W. Baker.... 311,711
Car coupling, Downer & Beach.... 311,730
Car coupling, D. P. Edgar.... 311,651
Car coupling, A. C. Lubbert, H.... 311,663
Car coupling, W. Muller.... 311,667
Car coupling, D. L. Richards.... 311,528
Car coupling, W. N. Sewell.... 311,535
Car coupling, J. J. Wolfe.... 311,698
Car coupling, C. S. Woodman.... 311,708
Car, railway, T. L. Wilson.... 311,553
Car starter, A. R. Witmer.... 311,627
Car, stock, G. D. Burton.... 311,719
Car, stock, J. E. Pierce.... 311,781
Car warmer, J. Q. C. Searle.... 311,533, 311,534
Car wheel, W. Joslin.... 311,837
Cars, fastening device for the doors of freight, H. E. Hoke.... 311,761
Carbon battery element, I. L. Roberts.... 311,852
Carriage top support, F. Ege.... 311,731
Carrier. See Hay carrier. Sheaf carrier.
Case. See Cigarette case. Watch case.
Cash and parcel carrying system for store service, J. K. P. Nourse.... 311,513
Centering tool, G. W. Varnum.... 311,619
Centrifugal reel, W. D. Gray.... 311,838
Churn, T. M. Smiley.... 311,685
Chute, ash, H. Pashley.... 311,674
Cider press, S. Ballard.... 311,713
Cigar boxes, spring follower for, M. Michaelis.... 311,507
Cigar holder, Keith & Sutherland.... 311,497
Cigarette case, W. H. Butler.... 311,641, 311,642
Clamp. See Flooring clamp.
Clasp. See Spring clasp.
Cleaner. See Peanut cleaner.
Clock, alarm, W. D. Smith.... 311,540
Coal or ore bucket or carrier, A. N. Simmerly.... 311,789
Coal screen and dust receiver combined, Gridley & Johnson.... 311,485
Cock for gas and water fittings, H. P. Drew.... 311,650
Coffins, supporting button for, S. E. Bauder.... 311,715
Condenser and heater, J. Kirkaldy.... 311,839
Cooking vessel, steam, A. J. Dudley.... 311,821
Cooler. See Corpse cooler.
Corking machine, Bannwart & Ermold.... 311,634
Corpse cooler and preserver, H. C. Johnson.... 311,764
Cotton and hay press, B. J. Curry.... 311,816
Coupling. See Car coupling. Fence wire coupling. Thill coupling.
Cross-heads, device for removing, C. A. Mackay.. 311,789
Cultivator, R. Cracraft.... 311,645
Cultivator, P. J. Hostetler *et al*.... 311,832
Cultivator, corn, A. J. Sweeney.... 311,689
Cut-off and reversing gear, H. H. Meyer.... 311,775
Cutter. See Axle cutter. Ensilage cutter. Sprue cutter.
Cutter head, J. A. Roberts.... 311,679
Die stock, F. E. Wells.... 311,549
Digger. See Potato digger.
Ditching machine, Murray & Stryker.... 311,606
Door check, L. Pentz.... 311,604
Door check, pneumatic, W. Gilfillan.... 311,742
Door hanger, W. E. Warner.... 311,697
Door plate, S. Porter.... 311,782
Door stop and holder, Jay & Garvey.... 311,836
Draught equalizer, C. Kieser.... 311,838
Drier. See Paper drum and barrel drier.
Drilling machine, E. Anderson.... 311,709
Dyeing yarns, apparatus for, C. Corron.... 311,568
Eggs, composition for preserving, C. U. Chamberlin.... 311,470
Electric battery, I. L. Roberts.... 311,853
Electric battery, A. M. Young.... 311,630
Electric circuit, W. A. Shaw.... 310,882
Electric circuit connection, T. T. Smith.... 311,616
Electric circuit opener, W. H. Sawyer.... 311,681
Electric machine, dynamo, F. G. Waterhouse.... 311,547
Electrical apparatus, demonstrative, J. D. Culp.... 311,735
Electrical connecting cord, W. H. Sawyer.... 311,611
Elevator. See Water elevator.
Elevator, C. W. Hays.... 311,489
Elevator, V. W. Mason.... 311,504
Elevator, Rau & Munch.... 311,783
Elevator for hoisting and lowering and automatically discharging barrels, etc., H. McQuire.... 311,773
Elevators and hoists, automatic safety brake for, D. C. De la Jeanniere.... 311,649
Engine. See Rotary steam engine. Traction engine.
Ensilage cutter, J. Y. Smith.... 311,538
Eyeglass frame, S. B. Opdyke.... 311,602
Eyeglass springs, machine for making, E. J. Watson.... 311,543
Eyeglasses or spectacles, C. Slotterbek.... 311,615
Fanning mill, Fabing & Ackermann.... 311,733
Fence, barbed wire, F. D. Ford.... 311,740
Fence latch, wire, L. R. Orr.... 311,603
Fence post, E. R. Annable.... 311,710
Fence post, P. Vanbriggle.... 311,698
Fence wire coupling, Fuller & Hallock.... 311,480
Fender. See Plow fender.
Fibrous materials, etc., chain and chain wheel for machinery for preparing, J. Good.... 311,577
Firearm, magazine, A. Burgess (r).... 10,555
Firearm safety lock, C. J. Ehbets.... 311,730
Firearm stock, J. Hermle.... 311,755
Fire escape, J. H. Bowley.... 311,805
Fire escape, C. W. Joynt.... 311,661
Fire escape, R. H. Nichols.... 311,600
Fire lighter and kindler, N. Archibald.... 311,462
Flooring clamp, A. Redman.... 311,608
Flour, etc., apparatus for feeding, A. D. Northrup.... 311,670
Flour packer, H. P. Chapman.... 311,811
Fluid regulator and cut-off, J. T. Hambay.... 311,747
Fork. See Hay fork.
Fresco work, E. S. Miragoli.... 311,509
Furnace. See Calcining and chloridizing furnace. Hot air furnace. Puddling and heating furnace.
Furnaces of locomotive boilers, supplying air to the, T. C. Craven.... 311,475
Gauge. See Rule gauge. Water gauge.
Galvanic battery porous cup, C. P. Orne.... 311,516
Garden implement, C. Marshall.... 311,508
Garter slide, D. S. Thompson.... 311,691
Gas, apparatus for manufacturing, Granger & Collins, Jr.... 311,483
Gas generating apparatus, A. O. Granger.... 311,484
Gas generating apparatus, I. James.... 311,486
Gas lighting apparatus, knob for electric, F. Lane.... 311,840
Gas machine, W. C. Strong.... 311,858
Gas works, hydraulic main for, C. W. Isbell.... 311,585
Gate. See Swinging gate.
Gold leaf, booking, E. Ewing.... 311,823
Governor, steam engine, J. M. Mason.... 311,770
Grain binder, H. R. Ingledue.... 311,492
Grain from vehicles, device for unloading, J. H. Brown.... 311,468
Grain, etc., gradual reduction machine for, W. D. Gray.... 311,829
Grain separator and scourer, J. Damp.... 311,727
Grapple for lifting and moving barrels, A. Flansburgh.... 311,478
Grate bar, N. L. Austin.... 311,633
Grate bar, C. F. Palmer.... 311,517
Grinding mill, F. Wilson.... 311,626
Guard. See Ink well guard. Razor guard. Saw guard.
Gun, machine, J. S. Whitney.... 311,551
Hame, O. P. Letchworth.... 311,767
Handle. See Plow handle.
Hanger. See Door hanger. Shaft hanger.
Harrow, A. W. Thomas.... 311,544
Harrow, clod crusher, and stalk cutter, combined, D. M. McElhaney.... 311,842
Harvester, corn, Randall & Snow.... 311,526
Harvester covering, J. F. Steward.... 311,542
Harvesting knife, F. Stafford.... 311,792
Hat bodies, machine for forming, J. Gill.... 311,826
Hat sizing machine, Elwell & Fay.... 311,572
Hat sweat, M. Haslam.... 311,751
Hatchway cover, elevator, W. H. Skerritt.... 311,694
Hay carrier, H. K. Vandewalker.... 311,545
Hay fork, horse, F. A. Dennett.... 311,728
Hay ladder, H. D. Robinson.... 311,531
Hay rake and tedder, combined, C. Perrin.... 311,847
Hay tedder, J. Skinner.... 311,614
Heating and cooling coil and producing the same, F. Wilhoft.... 311,553
Heating device, steam, E. A. Wood.... 311,704
Hinge, strap, B. D. Palmer.... 311,518
Hoisting and conveying apparatus, J. O'Neill.... 311,671
Holder. See Book holder. Cigar holder. Pen holder. Pencil holder. Stereotype plate holder. Trace holder.
Hook. See Button hook. Ice hook. Shap hook.
Hoopskirt, E. Strouse.... 311,859
Horse power motor, P. Fisher.... 311,737
Hose case or box, fire, J. T. Hawkins.... 311,752
Hot air furnace, A. Mann.... 311,502
Hot air furnace, T. Nugent.... 311,845
Ice hook, J. G. Bodenstein.... 311,630
Ice scraper, L. Halloweil.... 311,746
Indicator. See Railway switch indicator. Station indicator.
Inhaler, E. Nitz.... 311,776
Injector, feed water, J. Loftus.... 311,500
Ink well guard, A. M. Rittenhouse.... 311,678
Iron and steel, manufacture of, J. Grottenthaler.. 311,830
Jack, Beecher & Smart.... 311,716
Kiln. See Tile kiln.
Knob attachment, door, N. Hawkes.... 311,753
Laces, tool for affixing metal tags to, A. D. Delaviere.... 311,571
Lamp, M. Matthews.... 311,505
Lamp, electric arc, B. B. Ward.... 311,546
Lamp, extension, Parker & Griswold.... 311,520
Lamp fixture, extension, R. B. Perkins.... 311,779
Lamp for marine and land purposes, inextinguishable, J. R. Holmes.... 311,748
Lamp, portable electric, T. T. Smith.... 311,617
Lamp shade suspension device, D. W. Parker.... 311,519
Lasting machine, E. P. Richardson.... 311,850, 311,851
Latch and lock, combined, F. J. Biggs.... 311,627
Latch, gate, A. G. Rockfellow.... 311,787
Latch, reversible, D. H. Fitzgerald.... 311,575
Lath, J. Morrison, Jr.... 311,995
Leather, machine for putting out and cleaning, J. Hodskinson.... 311,582
Leather rolling machine, D. Knox.... 311,498
Light. See Skylight.
Link or pitman, S. Arnold.... 311,559
Lock. See Firearm safety lock. Trunk lock.
Locking device for sliding doors, D. Hoke.... 311,760
Locomotive, F. Newhouse.... 311,601
Locomotive ash pan, C. M. Lake (r).... 10,556
Locomotive journal lubricator, E. Graham.... 311,744
Lubricant, H. Riedel.... 311,529
Lubricator. See Car lubricator.
Lubricator, I. Frechette.... 311,576
Mandrel, expanding, G. Shelley.... 311,788
Mashing and cooking grain, method of and apparatus for, F. O. Kunz.... 311,500
Mechanical movement, J. H. Carrington.... 311,643
Metal extracting apparatus, W. Hamilton.. 311,748, 311,749
Metals, apparatus for recovering volatilized, A. F. Wendt.... 311,699
Middlings purifier, Butler & McFeely.... 311,808
Middlings purifiers, cleaning brush for, C. Wehner.... 311,622
Mill. See Fanning mill. Grinding mill. Roller mill. Rolling mill.
Millstone pick handle, H. P. Dickson.... 311,476
Mortar pestles, device for actuating, S. L. Hockert.... 311,560

Motion, device for converting, G. W. Richardson. 311,610
Motor. See Horse power motor.
Napkin pin or holder, A. L. Burlingame..... 311,640
Nest, hen's, F. M. Brown..... 311,467
Nozzle, C. Callahan..... 311,720
Nut arbor, G. B. Foote..... 311,479
Oil can, H. B. Hart..... 311,480
Oil can lamp filling attachment, W. Bloomfield.... 311,465
Oils, refining, reducing, and separating hydrocarbon, E. W. Strain..... 311,543
Ore concentrator, Cherney & Davis..... 311,803
Organ pedal attachment, J. Swanson..... 311,688
Packing, asbestus, J. Dewrance..... 311,729
Packing, steam joint, Adams & Lee..... 311,707
Pad. See Truss pad.
Paint distributer, W. I. Armstrong..... 311,631
Pan. See Locomotive ash pan.
Paper drum and barrel drier, G. W. Laraway..... 311,489
Paper, machine for cutting sheets with oblique edges from webs of, J. Ball..... 311,559
Pavement, E. Heylyn..... 311,579
Peanut cleaner, J. Johnson..... 311,494, 311,495
Peanuts, machine for separating, A. W. Ballard.. 311,712
Pen, fountain, E. Tyrrell..... 311,861
Pen, fountain, P. E. Wirt..... 311,554
Pen holder, G. H. Allen..... 311,556
Pencil holder, B. H. Sheldon..... 311,613
Photograph burnishing machine, M. T. Baldwin.. 311,463
Piano pedal attachment, E. B. Haynes..... 311,754
Pile box, J. A. Walsh..... 311,696
Pill machine, A. F. Ward..... 311,620
Pin. See Napkin pin.
Pipe. See Tobacco pipe.
Piston, H. L. Brown..... 311,806
Piston and valve rod, J. McGrail..... 311,665
Planter, corn, G. Leeper..... 311,795
Planter, corn, M. & A. Runstetler..... 311,855
Planter, corn, J. P. Simmons..... 311,683
Planter drilling attachment, corn, A. C. Evans.... 311,574
Plaque, E. McLoughlin..... 311,772
Plow, G. E. Blaine..... 311,564
Plow, F. M. Mott..... 311,511
Plow fender, W. H. Stone..... 311,857
Plow handle, H. D. Spangler..... 311,790
Plow, sulky, O. H. Field..... 311,736
Pool rack, C. Miller..... 311,843
Post. See Fence post.
Potato digger, W. Benedict..... 311,635
Press. See Baling press. Cider press. Cotton and hay press. Printing press.
Press, W. S. Ford..... 311,824
Printing press, G. P. Fenner..... 311,715
Propeller wheels, device for moulding, J. Dalgarno..... 311,817
Puddling and heating furnace, T. H. Bennett..... 311,802
Pump, H. F. Hodges..... 311,581
Pump condenser, steam, H. T. Blackwell..... 311,638
Pumps and engines, piston for compressor and other, W. H. Worthen..... 311,629
Quotation indicating system, audible, F. B. Herzog..... 311,757
Rack. See Pool rack.
Radiator valve, steam, T. S. Hewitt..... 311,657
Rail cutting device, H. C. Kriete..... 311,589
Railway crossings, automatic alarm for, J. T. Pritchard..... 311,607
Railway switch, A. Ayres..... 311,901
Railway switch indicator, G. Otte..... 311,846
Railways, etc., automatic time signal for, Young & Davis..... 311,706
Rake. See Hay rake.
Rattan, die for cutting, Heywood & Pratt..... 311,658
Razor guard, A. V. Brokhalme..... 311,466
Reel. See Centrifugal reel.
Refrigerating machine, C. G. Mayer..... 311,506
Refrigerator, Collings & Pike..... 311,813, 311,814
Regulator. See Fluid regulator. Watch regulator.
Rheostat, J. Doyle..... 311,820
Rigging stretcher, H. H. Pickenpack..... 311,606
Rock drilling machine, J. M. Richardson..... 311,786
Roller mill, J. D. Millar..... 311,508
Rolling mill, rail, H. C. Kriete..... 311,588
Roofing bracket, E. Prescott..... 311,676
Roofing, composite, W. Coultas..... 311,569
Rope stopper, W. M. Bullivant..... 311,565
Rotary steam engine, J. Beystrum..... 311,718
Rule gauge, Hunt & Bressler..... 311,584
Saddle, harness, W. H. Sipperly..... 311,856
Saw fitting tool, W. Golden..... 311,481
Saw guard, J. G. Groff..... 311,486
Sawmill head block, T. S. Wilkin..... 311,701
Saw tooth, insertible, J. C. Trullinger..... 311,692
Sawing machine, W. Lucas..... 311,501
Sawing machine, J. W. Poff..... 311,675
Scaffolding, J. T. Haskell..... 311,578
Scale, weighing, D. Hallock..... 311,745
Scissors, J. T. Willis..... 311,702
Scow, dumping, A. Weber..... 311,698
Scraper, road, R. N. Gowell..... 311,482
Screw machine feeding device, H. Reynolds..... 311,785
Scrubbing machine, J. F. Cameron..... 311,810
Seaming irregular shaped cans, machine for, W. H. Atkinson..... 311,632
Seat, removable school and church, S. Roush..... 311,854
Separator. See Grain separator.
Sewing machine bobbin winding attachment, A. T. Mollson..... 311,508
Sewing machine bemstitching attachment, W. R. Parsons..... 311,673
Sewing machine presser feet to their bars, device for fastening, L. J. Trussell..... 311,795
Sewing machine shuttle, J. & W. L. Heberling, 311,490, 311,491
Sewing machine spool holder, J. C. Roth..... 311,532
Sewing machine trimmer, H. H. Fefel..... 311,734
Sewing or embroidering machines, fixing cords or braids to textile fabrics by means of, E. Cornely..... 311,644
Shaft hanger, W. J. Perkins..... 311,780
Sheaf carrier, W. N. Whiteley..... 311,550
Shoe, rubber, C. Cleves..... 311,473
Syrup, etc., heater and evaporator for, Ysaba y Lazarte & Larea..... 311,779
Skate, C. H. Johnson..... 311,763
Skate, roller, J. Lovett..... 311,841
Skid, barrel, A. G. Grummann..... 311,655
Skylight, R. H. Reilie..... 311,784
Sled, P. H. Cummins..... 311,726
Snap hook, G. D. Spielman..... 311,791
Soap composition, H. Zahn..... 311,555
Spit, M. E. Knight..... 311,662
Spittoon, T. Bergmann..... 311,636
Splint cutting machine, J. D. Jones..... 311,496
Spring. See Vehicle spring. Watch case spring.
Spring clasp, E. S. Smith..... 311,536
Sprinkling apparatus, N. O. Bartley..... 311,560
Spring seat support, B. G. Meinikheim..... 311,506
Sprue cutter, F. C. Fladd..... 311,738
Starch in amylaceous substances, liquefaction, dextrination, and saccharification by means of malt of the, L. Cuisinier..... 311,646
Station indicator, C. H. Jenne..... 311,595
Steam engine, D. W. Amos..... 311,708
Steam engine reversing gear, W. A. Clarke..... 311,812
Steam pipe covering, J. M. Hammill..... 311,750
Steam supply system, N. W. Pratt..... 311,606
Steam trap, return, J. McGwin..... 311,507
Steel jars, die for making, J. J. Davin..... 311,648
Stereotype plate holder, E. E. Pratt..... 311,534
Stiffening strip and producing the same, E. K. Warren..... 311,621
Stone, apparatus for the manufacture of artificial, C. I. Walker..... 311,694
Stone sawing machine, P. Gay..... 311,741
Stopper. See Rope stopper.
Stove, M. W. Gardner..... 311,653
Stove, D. Lindahl..... 311,592
Stove door, W. L. McDowell..... 311,771
Stove door knob, W. J. Irwin..... 311,762
Submarine tunnels and tubes, apparatus for laying, H. H. Hall..... 311,656
Swinging gate, W. S. Bangs..... 311,714
Switch, E. H. Allcutt..... 311,461
Table rail tenoning and grooving machine, H. J. Durgin..... 311,822
Tablet, record, J. Crockett..... 311,724
Target, flying, G. Ligowsky..... 311,768
Telegraph cable, W. R. Patterson..... 311,521
Telegraph cables, hanging, W. R. Patterson..... 311,523
Telegraph cables, repairing, W. R. Patterson..... 311,522
Telegraph, combined audible stock quotation system and fire, F. B. Herzog..... 311,756
Thill coupling, G. W. Blair..... 311,464
Thill coupling, J. L. Downing..... 311,819
Thill coupling, J. L. H. Mosier..... 311,600
Thrasher, traveling, D. Young..... 311,705
Tile kiln, G. Jennings..... 311,660
Tobacco pipe, W. R. Chadsey..... 311,469
Toy, building, W. Stranders..... 311,793
Trace holder, J. Strong..... 311,686
Traction engine, F. W. Robinson..... 311,530
Trap. See Animal trap. Steam trap.
Trunk catch, T. F. Conklin..... 311,721
Trunk lock, W. Hoehn..... 311,759
Truss, J. Cronin..... 311,570
Truss pad, I. N. Foote..... 311,739
Tube making machine, Fisher & Herrick..... 311,477
Tug and trace fastening, hame, W. H. Tyler..... 311,796
Unwinding attachment for spools and bobbins, C. E. Wilkinson..... 311,625
Valve, B. W. Hoxie..... 311,833
Valve, relief, W. B. Coulter..... 311,723
Valve, throttle, E. Lunkenheimer (r)..... 10,557
Vapor burner, Z. Davis..... 311,818
Vehicle running gear, Gesner, Jr., & Stevens..... 311,654
Vehicle spring, G. W. Bunn..... 311,807
Vehicles, umbrella covering for, C. H. Butlin..... 311,809
Velocipede, ice, C. Wunsch..... 311,862
Vessels, attaching tops to, D. W. Norris..... 311,777
Vessels, elastic joint for the planking of, C. E. Mark..... 311,503
Vessels, mechanism relating to chain stoppers and windlasses of navigable, J. J. Emery..... 311,573
Vise, T. G. Hall..... 311,487
Walls, deafening or filling for, L. E. Clawson..... 311,567
Wash boiler, M. R. Walpole..... 311,695
Watch, A. Chopard..... 311,566
Watch, alarm, C. Masmejan..... 311,594
Watch balance, J. E. A. Uhrig..... 311,797
Watch case, Harman & Skidmore (r)..... 10,556
Watch case spring, T. L. Bear..... 311,563
Watch regulator, G. P. Reed..... 311,609
Water closet bowls, apparatus for flushing, T. Keyworth..... 311,587
Water closet cisterns, valve mechanism for, G. R. Moore..... 311,509
Water elevator, E. McAllister..... 311,664
Water gauge, G. S. Chase..... 311,471
Water wheels, valve gear for high speed, I. Lepley..... 311,591
Weather strip, S. Funk..... 311,825
Weed killing machine, J. P. Rand..... 311,525
Wheel. See Bicycle wheel. Car wheel.
Whip socket and rein holder, combined, E. M. Crumley..... 311,815
Window fastener, G. H. Kanmacher..... 311,765
Window screen, J. R. Graver..... 311,827

DESIGNS.

Badge or breastpin, D. F. Adams..... 15,756
Carpet, J. L. Folsom..... 15,768
Carpet, A. Heald..... 15,769
Carriage step, C. A. Babcock..... 15,757 to 15,762
Curtain fabric, P. McCaffray..... 15,765
Lamp reservoir, G. W. Woodward..... 15,781
Oil cloth, C. T. & V. E. Meyer..... 15,771 to 15,776
Paper cutter, T. C. Brecht..... 15,764
Pendant, P. Dreyfus..... 15,766
Radiator leg or loop, G. W. Walker..... 15,779
Rug, W. T. Smith..... 15,778
Stove, cooking, H. S. Bascom..... 15,763
Tile floor or pavement, M. Wiese..... 15,780
Trunk iron, M. Maier..... 15,770
Type, P. J. Dawkins..... 15,767
Type, font of printing, J. K. Rogers..... 15,777

TRADE MARKS.

Beer, barley, Wheeler & Hereld..... 11,904
Belting for machinery, certain, New York Belting and Packing Company..... 11,897
Beverage known as Jamaica rum and maple sugar, compounded, Steinhardt Bros..... 11,900
Cigars, Grommes & Ulrich..... 11,894
Cordial for summer complaints, L. H. Harris..... 11,896
Cultivator, Burton Handle Company..... 11,891
Forgings, metal, J. H. Williams & Co..... 11,905
Leather of all descriptions, J. S. Rockwell & Co.... 11,898
Medicine for the cure of cramps, L. H. Harris..... 11,895
Pails and analogous vessels, lard, F. A. Walsh & Co..... 11,902
Peptonized meat, Compagnie Peptones des Viande du Docteur Kochs (Societe Anonyme)..... 11,892
Preparation for asthma, catarrh, hay fever, and certain other diseases, solid, H. H. Warner..... 11,903
Salves, H. F. Tower..... 11,901
Tobacco, Havana leaf, J. B. Creagh..... 11,893
Whisky, malt, Rosskam, Gerstley & Co..... 11,899

A printed copy of the specification and drawing of any patent in the foregoing list, also of any patent issued since 1865, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 361 Broadway, New York. We also furnish copies of patents granted prior to 1865; but at increased cost, as the specifications, not being printed, must be copied by hand.

Canadian Patents may now be obtained by the inventors for any of the inventions named in the foregoing list, at a cost of $40 each. For full instruction address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

FOREIGN PATENTS.
Their Cost Reduced.

The expenses attending the procuring of patents in most foreign countries having been considerably reduced the obstacle of cost is no longer in the way of a large proportion of our inventors patenting their inventions abroad

CANADA.—The cost of a patent in Canada is even less than the cost of a United States patent, and the former includes the Provinces of Ontario, Quebec, New Brunswick, Nova Scotia, British Columbia, and Manitoba.

The number of our patentees who avail themselves of the cheap and easy method now offered for obtaining patents in Canada is very large, and is steadily increasing.

ENGLAND.—The new English law, which went into force on Jan. 1st, enables parties to secure patents in Great Britain on very moderate terms. A British patent includes England, Scotland, Wales, Ireland and the Channel Islands. Great Britain is the acknowledged financial and commercial center of the world, and her goods are sent to every quarter of the globe. A good invention is likely to realize as much for the patentee in England as his United States patent produces for him at home, and the small cost now renders it possible for almost every patentee in this country to secure a patent in Great Britain, where his rights are as well protected as in the United States.

OTHER COUNTRIES.—Patents are also obtained on very reasonable terms in France, Belgium, Germany, Austria, Russia, Italy, Spain (the latter includes Cuba and all the other Spanish Colonies), Brazil, British India, Australia, and the other British Colonies.

An experience of FORTY years has enabled the publishers of THE SCIENTIFIC AMERICAN to establish competent and trustworthy agencies in all the principal foreign countries, and it has always been their aim to have the business of their clients promptly and properly done and their interests faithfully guarded.

A pamphlet containing a synopsis of the patent laws of all countries, including the cost for each, and other information useful to persons contemplating the procuring of patents abroad, may be had on application to this office.

MUNN & CO., Editors and Proprietors of THE SCIENTIFIC AMERICAN, cordially invite all persons desiring any information relative to patents, or the registry of trade-marks, in this country or abroad, to call at their offices, 361 Broadway. Examination of inventions, consultation, and advice free. Inquiries by mail promptly answered.

Address, **MUNN & CO.,**
Publishers and Patent Solicitors,
361 Broadway, New York.
Branch Office, cor. F and 7th Streets, opposite Patent Office Washington, D. C.

The Scientific American.

THE MOST POPULAR SCIENTIFIC PAPER IN THE WORLD.

Published Weekly, $3.20 a Year; $1.60 Six Months.

This unrivaled periodical, now in its **forty-first year**, continues to maintain its high reputation for excellence, and enjoys the largest circulation ever attained by any scientific publication.

Every number contains sixteen large pages, beautifully printed, elegantly illustrated; it presents in popular style a descriptive record of the most novel, interesting, and important advances in Science, Arts, and Manufactures. It shows the progress of the World in respect to New Discoveries and Improvements, embracing Machinery, Mechanical Works, Engineering in all branches, Chemistry, Metallurgy, Electricity, Light, Heat, Architecture, Domestic Economy, Agriculture, Natural History, etc. It abounds with fresh and interesting subjects for discussion, thought, or experiment; furnishes hundreds of useful suggestions for business. It promotes Industry, Progress, Thrift, and Intelligence in every community where it circulates.

The SCIENTIFIC AMERICAN should have a place in every Dwelling, Shop, Office, School, or Library. Workmen, Foremen, Engineers, Superintendents, Directors, Presidents, Officials, Merchants, Farmers, Teachers, Lawyers, Physicians, Clergymen, people in every walk and profession in life, will derive benefit from a regular reading of THE SCIENTIFIC AMERICAN.

Terms for the United States and Canada, $3.20 a year; $1.60 six months. Specimen copies free. Remit by Postal Order or Check.

MUNN & CO., Publishers,
361 Broadway, New York.

THE Scientific American Supplement.

THE SCIENTIFIC AMERICAN SUPPLEMENT is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information pertaining to these and allied subjects is given, the whole profusely illustrated with engravings.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are represented and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year, or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Address and remit by postal order or check,

MUNN & Co., 361 Broadway, N. Y.,
Publishers SCIENTIFIC AMERICAN.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, one year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for one year. This includes postage, which we pay. Remit by postal order or draft to order of

MUNN & CO., 361 Broadway, New York.